Clean Water Act Section 319(h) Nonpoint Source Pollution Control Program

Surface Water Quality Monitoring to Support Implementation of the Mill Creek Watershed Protection Plan

TSSWCB Project Number 16-11
Revision #0

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Prepared by

Houston-Galveston Area Council
and
Texas A&M AgriLife Extension Service

Effective Period: Upon EPA approval through January 31, 2019
(with Annual Updates Required)

Questions concerning this quality assurance project plan should be directed to:

Jean Wright
Sr. Environmental Planner
Houston-Galveston Area Council
P.O. Box 22777
Houston, TX 77227-2777
jean.wright@h-gac.com

A1 APPROVAL PAGE

Surface Water Quality Monitoring to Support Implementation of the Mill Creek Watershed Protection Plan

United States Environmental Protection Agency (EPA), Region VI

Name: Curry Jones
Title: EPA Chief; State/Tribal Programs Section

Signature: _____ Date: _____

Name: Henry Brewer
Title: EPA Texas Nonpoint Source Project Officer

Signature: _____ Date: _____

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Jana Lloyd
Title: TSSWCB Project Manager

Signature: _____ Date: _____

Name: Mitch Conine
Title: TSSWCB Quality Assurance Officer (QAO)

Signature: _____ Date: _____

Texas A&M AgriLife Extension Service (AgriLife)

Name: Jake Mowrer
Title: Texas A&M AgriLife Extension Project Lead

Signature: _____ Date: _____

Name: ~~Jennifer Cary~~ Ward Ling
Title: Texas A&M AgriLife Extension Project Co-Leader

Signature: _____ Date: _____

AgriLife will secure written documentation from each sub-tier project participant (e.g., subcontractors, other units of government, laboratories) stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan and any amendments or added appendices of this plan. AgriLife will maintain this documentation as part of the project's quality assurance records, and will be available for review. H-GAC will also have copies of this documentation for their permanent records.

Houston-Galveston Area Council (H-GAC)

Name: Todd Running
Title: H-GAC Project Manager

Signature: _____ Date: _____

Name: Jean Wright
Title: H-GAC Project Quality Assurance Officer (QAO)

Signature: _____ Date: _____

Eastex Environmental Laboratory (Eastex)

Name: Daniel Bowen
Title: Eastex Lab Manager

Signature: _____ Date: _____

Name: Natalia Bondar
Title: Eastex Lab Quality Assurance Officer (QAO)

Signature: _____ Date: _____

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List of Acronyms and Abbreviations

AgriLife	Texas A&M AgriLife Extension Service
ASTM	American Society for Testing and Materials
AWRL	Ambient Water Reporting Limit
BMP	Best Management Practices
BRA	Brazos River Authority
CAR	Corrective Action Report
CFU	Colony Forming Units
COC	Chain-of -Custody
CR	County Road
CRP	Clean Rivers Program
DM	Data Manager
DMRG	Data Management Reference Guide
DO	Dissolved Oxygen
Eastex	Eastex Environmental Laboratory
FY	Fiscal Year
H-GAC	Houston-Galveston Area Council
LCS	Laboratory Control Sample
LOD	Limit of Detection
LOQ	Limit of Quantitation
MC WPP	Mill Creek Watershed Protection Plan
mL	Milliliters
MPN	Most Probable Number
NELAC	National Environmental Laboratory Accreditation Committee
NELAP	National Environmental Laboratory Accreditation Program
NPS	Nonpoint Source
PM	Project Manager
QA	Quality Assurance
QAM	Quality Assurance Manual
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
SM	Standard Methods
SOP	Standard Operating Procedure
SWQM	Surface Water Quality Monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TCEQ	Texas Commission on Environmental Quality
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids
TSSWCB	Texas State Soil and Water Conservation Board
TSWQS	Texas Surface Water Quality Standards
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
WPP	Watershed Protection Plan

A3 DISTRIBUTION LIST

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

EPA
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Name: Henry Brewer
Title: Texas Nonpoint Source Project Officer, Water Quality Protection Division

Texas State Soil and Water Conservation Board (TSSWCB)
1497 Country View Ln
Temple, Texas 76504

Jana Lloyd
TSSWCB PM

Mitch Conine
TSSWCB QAO

Texas A&M AgriLife Extension Service (AgriLife)
Department of Soil and Crop Sciences
2474 TAMU
College Station, TX 77843

Jake Mowrer
Project Leader

Jennifer Cary
Project Co-Leader

Houston-Galveston Area Council (H-GAC)
P.O. Box 22777
Houston, TX 77227-2777

Todd Running
Project Manager, Water Resources Program Manager

Jean Wright
Project QAO, Senior Planner

Eastex Environmental Laboratory (Eastex)
P.O. Box 1089
Coldspring, TX 77331

Daniel Bowen
Laboratory Manager

Natalia Bondar
Laboratory Quality Assurance Officer

AgriLife will provide copies of this project plan and any amendments or appendices of this plan to each person on this list and to each sub-tier project participant, e.g., subcontractors, other units of government, laboratories. AgriLife will document distribution of the plan and any amendments and appendices, maintain this documentation as part of the project's quality assurance records, and will be available for review.

A4 PROJECT/TASK ORGANIZATION

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

EPA

Henry Brewer, EPA Project Officer
Responsible for managing the project for EPA. Reviews project progress and reviews and approves QAPP and QAPP amendments.

Texas State Soil and Water Conservation Board (TSSWCB)

Jana Lloyd, TSSWCB PM
Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Responsible for submitting data sets to TCEQ's Data Management and Analysis Team. Provides the primary point of contact between AgriLife, H-GAC, TSSWCB and TCEQ. Tracks and reviews deliverables to ensure that tasks in the workplan are completed as specified in the contract. Responsible for verifying that the QAPP is followed by the H-GAC. Notifies the TSSWCB QAO of significant project non-conformances and corrective actions taken as documented in quarterly progress reports from AgriLife and H-GAC.

Mitch Conine, TSSWCB QAO
Reviews and approves the project QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants. Assists the TSSWCB Project Manager on QA-related issues. Coordinates reviews and approvals of QAPPs and amendments or revisions. Conveys QA problems to appropriate TSSWCB management. Monitors implementation of corrective actions. Coordinates and conducts audits.

Texas A&M AgriLife Extension (AgriLife)

Jake Mowrer, Project Leader
Responsible for managing the project for AgriLife. Reviews project progress and reviews and approves QAPP and QAPP amendments. Responsible for implementing and monitoring MC WPP requirements in the contract and the QAPP. Responsible for maintaining records of QAPP distribution, including appendices and amendments. Responsible for maintaining written records of sub-tier commitment to requirements specified in this QAPP. Coordinates project planning activities and work of project partners. Ensures QAPP is followed by project participants and that project is producing data of known quality. Ensures that subcontractors are qualified to perform contracted work.

Jennifer Cary, Co-Project Leader
Verifies QAPPs are being followed by H-GAC and Eastex Lab and that project is producing data of known quality. Coordinates project planning with H-GAC Project Manager. Reviews and

approves data and reports produced by H-GAC. Notifies AgriLife Project Leader and TSSWCB PM and QAO of circumstances which may adversely affect the quality of data derived from the collection and analysis of samples. Develops, enforces, and monitors corrective action measures to ensure H-GAC meets deadlines and scheduled commitments.

Houston-Galveston Area Council (H-GAC)

Todd Running, H-GAC Project Manager and Field Supervisor
Responsible for ensuring tasks and other requirements in contracts, QAPPs, and QAPP amendments and appendices are executed on time and are of acceptable quality. Ensures monitoring systems audits are conducted to ensure QAPPs are followed and the project is producing data of known quality. Ensures that contractor lab is qualified to perform contracted work. Ensures AgriLife project managers are notified of deficiencies and corrective actions and that issues are resolved. Responsible for supervising sample collection, processing, handling, holding and reporting activities to ensure compliance with monitoring requirements.

Jean Wright, H-GAC Quality Assurance Officer (QAO)
Responsible for coordinating the implementation of the QA program. Responsible for writing and maintaining the QAPP and monitoring its implementation. Responsible for maintaining records of QAPP distribution, including appendices and amendments. Responsible for identifying, receiving, and maintaining project QA records. Responsible for coordinating with the H-GAC PM and AgriLife PM to resolve QA-related issues. Notifies the H-GAC Project Manager of particular circumstances which may adversely affect the quality of data. Coordinates and monitors deficiencies and corrective action. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Conducts monitoring systems audits on project participants to determine compliance with project and program specifications, issues written reports, and follows through on findings. Ensures that field staff is properly trained and that training records are maintained. Coordinates field personnel to ensure all monitoring is conducted as stated in approved QAPP. Responsible for validation and verification of all data collected according to Table A7.1 and QC specifications and acquired data procedures after each task is performed.

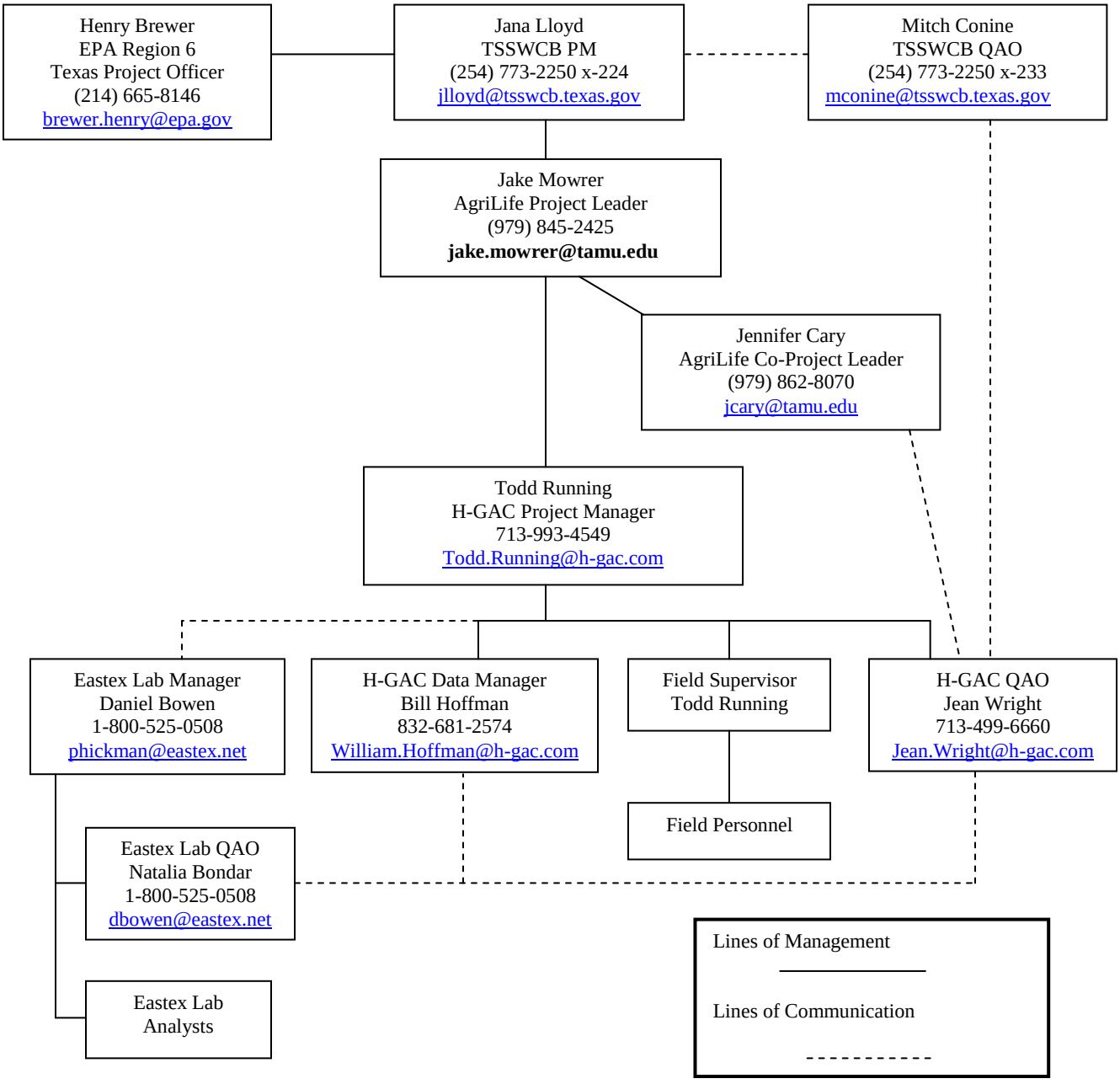
Bill Hoffman, H-GAC Data Manager (DM)
Responsible for ensuring that field data are properly reviewed and verified. Formats project data for QAO review. Coordinates and maintains records of data verification and validation. Completes the data summary reports, prepares the electronic data deliverables for submission to the TCEQ Data Management and Analysis team, and serves as primary contact with the TCEQ Data Management and Analysis team with respect to data management and data delivery. Submits data sets to TCEQ Data Management and Analysis Team via TSSWCB PM. Maintains quality-assured data on the H-GAC's internet sites.

Eastex Environmental Laboratory (Eastex)

Daniel Bowen Laboratory Director, Eastex Environmental Laboratory (Contract Lab)
Responsible for producing quality analytical data for samples collected and submitted by H-GAC. Responsible for ensuring tasks and other requirements in contracts, QAPPs, and QAPP amendments and appendices are executed on time and are of acceptable quality. Maintains verification of procedures establishing the level of quality. Responsible for sending data and COC forms to H-GAC within time specified in contract.

Natalia Bondar, Eastex Lab QAO
Coordinates and monitors the implementation requirements in contracts, QAPPs, and QAPP amendments and appendices. Checks training, competency, and re-training of technicians. Performs verification and validation procedures to confirm quality data is issued to clients. Performs other QA/QC duties and checks associated with lab activities. Responsible for ensuring that all method—and client—specific QA/QC requirements and data quality objectives are met. Responsible for the overall quality control and quality assurance of analyses performed by laboratory personnel. Ensures NELAP certification in CRP parameters. Conducts internal lab audits to ensure compliance with written SOPs, the laboratory QM/QAPP, the CRP QAPP, and NELAP, and to identify potential problems.

Figure A4.1 Project Organizational Chart*-- Lines of Communication



* See Project/Task Organization in this section for a description of each position's responsibilities.

A5 PROBLEM DEFINITION/BACKGROUND

Mill Creek (Segment 1202K) is the catchment source for a 256,000-acre watershed in the Brazos River Basin that is identified as impaired on the 2014 303(d) list due to bacterial contamination. Twenty-Six (26) samples were collected during the 7-year period between December 2005 and November 2012 and used for the assessment of Segment 1202K in the 2014 Texas Integrated Report. The geometric mean of these data for E. coli bacteria was 191.85 colony forming units per 100 milliliters (cfu/100 mL), which exceeds the state recreational use standard of 126 cfu/100 mL.

From the headwaters located in western Washington County, the east and west forks of the Mill Creek flow 25 miles southeast in Austin County where they converge 3.5 miles west of the City of Bellville. From there the Mill Creek (Segment 1202K) travels southeast through Austin County to its confluence with the Brazos River 3.9 miles north of FM1458 near the City of San Felipe, Texas. Cities within the Mill Creek watershed include Brenham, Burton, Industry, and Bellville. The City of Brenham (population around 17,000) expands a little over 8.8 square miles, but only a small portion of the southwest corner lies within the watershed boundaries. The City of Bellville, with a population slightly more than 4,100 is located in the lower reach of the watershed. While the city covers an area of 2.7 square miles, only the western half of the city limits are within the Mill Creek watershed. The City of Industry, covering only 1.1 square miles and having a population of approximately 300, is situated midway up the western fork of Mill Creek. The City of Burton, covering 1.2 square miles and having a population of 300, is located near the headwaters of the east fork of Mill Creek.

The 2011 Brazos River Authority's (BRA) Basin Highlights Report indicated concerns for bacteria and an impaired fish community, suggesting that Mill Creek had poor habitat to support a large and diverse fish population. The 2012 BRA Basin Summary Report and the 2013 and 2015 BRA Basin Highlights Reports identified Mill Creek as not supporting its designated contact recreation use due to bacteria impairment.

The 2014 Texas Integrated Report lists the source of the bacteria impairment for Mill Creek as unknown. A watershed reconnaissance performed on Mill Creek in 2007 as part of a Recreational Use Attainability Analysis (RUAA) noted that land used in the watershed is used predominantly for agricultural purposes. However, results of the analysis also concluded the recreational contact use designation and concurrent water-quality standards were appropriate for Mill Creek. Currently and historically Mill Creek has supported contact recreation. The RUAA also noted the presence of three wastewater treatment plants in the watershed leaving all other commercial and residential structures being serviced by on-site sewer facilities (OSSFs) for wastewater treatment and disposal.

During the development of the Mill Creek WPP, which was part of TSSWCB project 14-57, a more thorough evaluation of watershed characteristics was performed through SELECT modeling. Results confirmed that causes of the bacterial impairment included urban, agricultural, and wastewater nonpoint source pollution.

The WPP was approved and signed by the Steering Committee in January of 2016 and accepted by EPA in February of 2016. The WPP identified a combination of management measures aimed at addressing these nonpoint sources. The timeline for full implementation of management measures identified in the Mill Creek WPP is 10 years. In support of adaptive implementation of the WPP, the Steering Committee requested routine, ambient water quality monitoring be conducted.

The Houston-Galveston Area Council (H-GAC) conducts surface water quality monitoring under the auspices of the Texas Clean Rivers Program (CRP). Currently, H-GAC and other local CRP partners collect valid, representative environmental data to accurately assess water quality conditions in the region and to support effective water quality decision making. Routine samples are collected from classified streams, reservoirs, and bay segments to monitor for the attainment of uses and numerical criteria. Unclassified water bodies are also monitored in response to perceived risk for pollution and/or to define water quality. For the Mill Creek Watershed project, H-GAC will conduct in-stream water quality monitoring at 8 targeted locations 6 times approximately every other month (a bi-monthly basis) for selected parameters through December 2018 in support of the Watershed Protection Plan (WPP) implementation project.

The purpose of this Quality Assurance Project Plan (QAPP) is to clearly delineate H-GAC's Quality Assurance (QA) policy, management structure, and procedures which will be used to implement the QA requirements necessary to verify and validate the surface water quality data collected. The QAPP is reviewed by the Texas State Soil & Water Conservation Board (TSSWCB) to help ensure that data generated are scientifically valid and legally defensible. This process will ensure that data collected under this QAPP and submitted to the Texas Commission on Environmental Quality (TCEQ) Surface Water Quality Monitoring Information System (SWQMIS) database have been collected and managed in a way that guarantees its reliability and, therefore, may be used in water quality assessments, watershed protection plan (WPP) development, establishing water quality standards, making permit decisions, and used by other programs deemed appropriate by the TCEQ or the TSSWCB.

A6 PROJECT/TASK DESCRIPTION

AgriLife will conduct work performed under this project associated with technical and financial supervision, preparation of status reports, and coordination with local stakeholders, data analysis and development of the final project report. AgriLife will facilitate the Mill Creek Watershed Partnership and appropriate Work Groups in order to efficiently and effectively achieve project goals and summarize activities and achievements made throughout the course of this project.

H-GAC will conduct all surface water quality monitoring, sample collection, and data preparation for submission to SWQMIS, as required. Sample analysis will be performed by Eastex Laboratory located in Coldspring, TX. All monitoring procedures and methods will follow the guidelines prescribed in this QAPP and the most current versions of TCEQ's *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring (RG-415).*

Following input from local stakeholders, numerous sites on Mill Creek and several tributaries were selected for monitoring. In this phase of the project, H-GAC will monitor 8 stations on a bi-monthly (every other month) basis collecting field and flow data along with water quality samples that will be analyzed for conventional and bacteria parameters. The sampling period extends over 1 year, generating a total of 48 routine samples. As soon as the QAPP is approved, routine monitoring will be pre-scheduled on approximately the same days every other month, or at least 30 days apart. Sampling will be conducted as scheduled as long as conditions do not create a safety hazards for the field crew. Sampling will reconvene as soon as the hazard has ceased or been eliminated. See Table A7.1 for all field parameters and the full suite of lab parameters to be analyzed at each site.

Figure A6.1 illustrates the Mill Creek watershed and the selected monitoring locations for this project. The sites are designated by the green dots.

Figure A6.1 Mill Creek Monitoring Stations

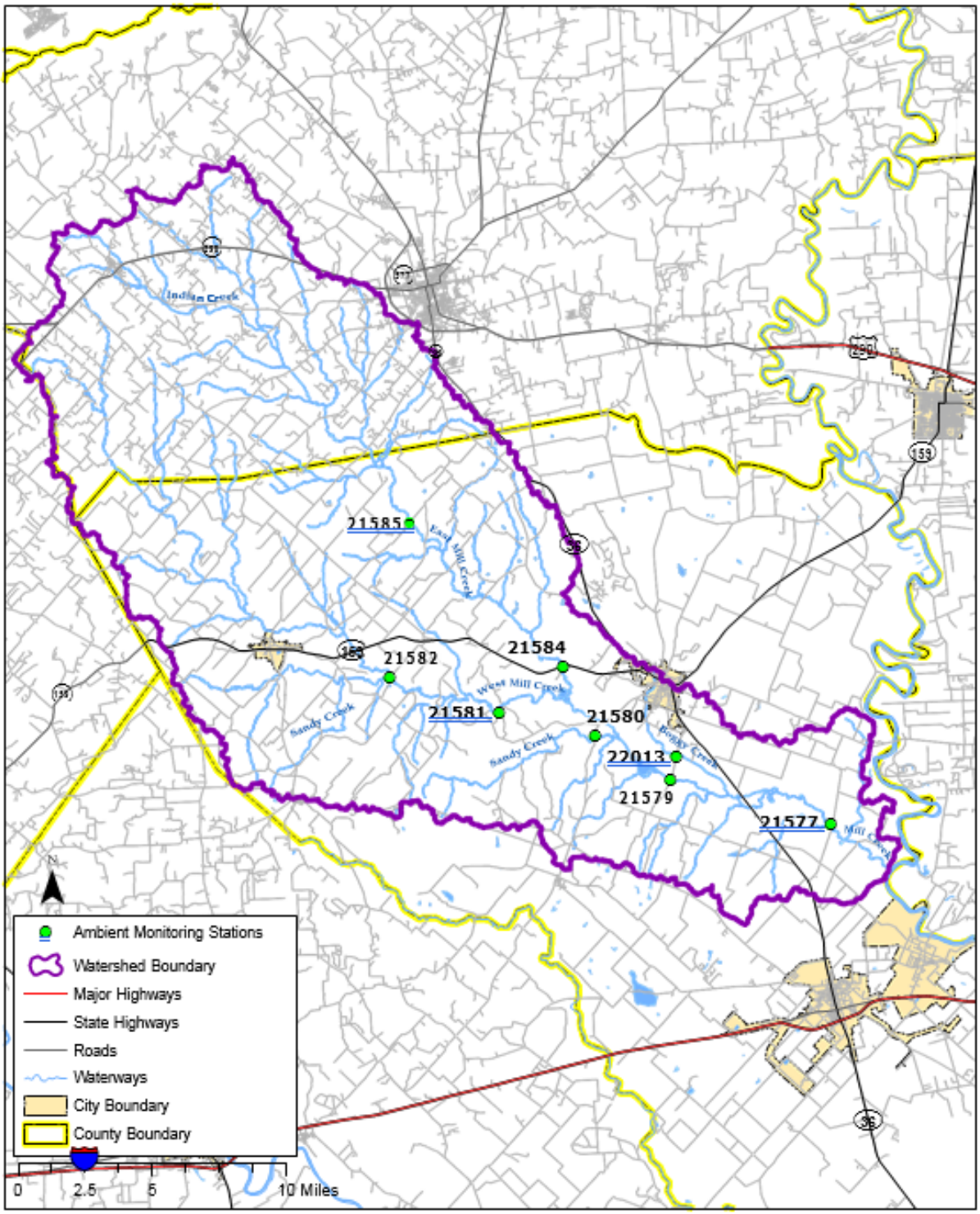


Table A6.1 Monitoring Stations and GIS Locations

Site#	Site_ID	TCEQ Station ID	Latitude Decimal	Long Decimal	Description
8	EMC-4	21585	30.039449	-96.413137	East fork Mill Creek at Bleiblerville Rd. About 1.5 km northwest of TCEQ station ID 20133.
7	EMC-6	21584	29.959612	-96.320151	East fork Mill Creek at FM 159/Old Nelsonville Rd, 1.5 km west of intersection of Koy Rd and FM 159.
6	WMC-4a	21582	29.9557127	-96.4276336	West Mill Creek at Tiemann Rd, east of Industry.
5	WMC-6	21581	29.935733	-96.360328	West fork Mill Creek adjacent to small lake between Artists Cir Dr and John Schoelikopf Rd approximately 7.7 km west of the Mill Creek Rd and Kuykendall Rd
4	SSC-1	21580	29.921135	-96.301334	Sandy Creek at Mill Creek Rd southwest of Bellville
3	20131-A	21579	29.896756	-96.254975	Mill Creek at FM 2429 5.13 km upstream of SH 36 and 5.25 km downstream of Mill Creek Road at approximately 5.78 km south of the City of Bellville in Austin County
2	BC-1	22013	29.909526	-96.251110	Boggy Creek at FM 2429 in Austin County
1	MC-2	21577	29.869637	-96.155232	Mill Creek at FM331, immediately downstream of bridge.

H-GAC will manage monitoring data in support of the Mill Creek WPP. H-GAC will submit monitoring data at least quarterly to TCEQ Data Management and Analysis Team via TSSWCB PM, using required TCEQ formatting and protocols. H-GAC will also provide copies of all data submission documents to AgriLife.

Table A6.2 presents project milestones pertaining to this project.

Table A6.2 Project Milestones

TASK	PROJECT MILESTONES	AGENCY	START	END
2.1	Develop QAPP for review by TSSWCB.	H-GAC & AgriLife	9/20/2017	11/30/2017
2.2	Submit revisions to QAPP as necessary.	H-GAC & AgriLife	9/20/2017	12/31/2018
3.1	Monitor 8 routine sites bi-monthly, collecting field, conventional, flow and bacteria parameter groups.	H-GAC	After 1/1/2018*	12/31/2018
3.3	Transfer monitoring data on quarterly basis to TCEQ Data Management and Analysis Team. Submit station location requests to TCEQ, if required. Submit data correction requests, if errors are discovered in reported data.	H-GAC	12/1/2017*	12/31/2018
3.4	Summarize water quality data and conduct statistical and trend analysis.	AgriLife	12/1/2017*	12/31/2018

*Monitoring cannot be started until QAPP is approved.

Amendments

Amendments to this QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives, and methods; address deficiencies and nonconformance; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests for amendments are directed from the contractor Project Manager to the TSSWCB NPS Project Manager in writing. The changes are effective immediately upon approval by the TSSWCB NPS Project Manager.

Amendments to the QAPP and the reasons for the changes will be documented, and full copies of amendments will be forwarded to all persons on the QAPP distribution list by the TSSWCB or H-GAC QAO.

A7 QUALITY OBJECTIVES AND CRITERIA FOR DATA QUALITY

The purpose of the water quality monitoring described in this QAPP is to collect surface water quality data that can be used to characterize water quality conditions in the Mill Creek watershed and support implementation of the Watershed Protection Plan (WPP). The water quality data and evaluations of water quality conditions will be communicated to the public and the Mill Creek Watershed Stakeholders to support adaptive management of the Mill Creek WPP and expand public knowledge on Mill Creek water quality data.

Systematic watershed monitoring is defined by sampling that is planned for a short duration (1 to 2 years) and is designed to: screen waters that would not normally be included in the routine monitoring program, monitor at sites to check the water quality situation, and investigate areas of potential concern. Due to the limitations regarding these data (e.g., not temporally representative, limited number of samples), the data

will be used to determine whether any locations have values exceeding the TCEQ's water quality criteria and/or screening levels (or in some cases values elevated above normal).

The measurement performance specifications to support the project objectives for a minimum data set are specified in Tables A7.1a, b, c, and d below.

Ambient Water Reporting Limits (AWRLs)

AWRLs establish the reporting specification at or below which data for a parameter must be reported to be compared with freshwater screening criteria. The AWRLs specified in Table A7.1 are the program-defined reporting specifications for each analyte and yield data acceptable for TCEQ water quality assessment. The limit of quantitation (LOQ) is the minimum level, concentration, or quantity of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The following requirements must be met in order to report results to the TCEQ SWQMIS:

- The laboratory's LOQ for each analyte must be at or below the AWRL as a matter of routine practice
- The laboratory must demonstrate its ability to quantitate at its LOQ for each analyte by running an LOQ check sample for each batch of samples analyzed.

Table A7.1a - Measurement Performance Specifications for Routine Systematic Monitoring Events – Field Parameters

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	AWRL	Lab
Temperature, Water (Degrees Centigrade)	°C	water	SM 2550 and TCEQ SOP, V1	00010	NA[1]	Field
Specific Conductance, Field (US/CM @ 25C)	µS/cm	water	EPA 1201 and TCEQ SOP, V1	00094	NA[1]	Field
pH (Standard Units)	standard units	water	EPA 150.1 and TCEQ SOP, V1	00400	NA[1]	Field
Oxygen, Dissolved (MG/L)	mg/L	water	SM 4500-O G. and TCEQ SOP, V1	00300	NA[1]	Field
Depth of Bottom of water body at sample site	meters	water	TCEQ SOP, V2	82903	NA[1]	Field
Transparency, Secchi Disc	meters	water	TCEQ SOP, V1	00078	NA[1]	Field
Days since precipitation event	days	other	TCEQ SOP V1	72053	NA[1]	Field
Maximum pool width at time of study[2]	meters	other	TCEQ SOP V2	89864	NA[1]	Field
Maximum pool depth at time of study[2]	meters	other	TCEQ SOP V2	89865	NA[1]	Field
Pool length[2]	meters	other	TCEQ SOP V2	89869	NA[1]	Field
% pool coverage in 500 meter reach[2]	%	other	TCEQ WOP V2	89870	NA[1]	Field
Wind Intensity (1=calm, 2=slight, 3=mod, 4=strong)	NU	other	NA	89965	NA	Field
Present Weather (1=clear, 2=ptcldy, 3=cldy, 4=rain, 5=other)	NU	other	NA	89966	NA	Field
Water Surface (1= calm, 2=ripple, 3=wave, 4=whitecap)	NU	water	NA	89968	NA	Field
Water Color (1=brownish, 2=reddish, 3=greenish, 4=blackish, 5=clear, 6=other)	NU	water	NA	89969	NA	Field
Water Odor (1=sewage, 2=oily/chemical, 3=rotten egg, 4=musky, 5=fishy, 6=none, 7=other)	NU	water	NA	89971	NA	Field

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	AWRL	Lab
Water clarity (1=excellent, 2=good, 3=fair, 4=poor)	NU	water	NA	20424	NA	Field
Turbidity, observed (1=low, 2=medium, 3=high)	NU	water	NA	88842	NA	Field
Primary contact, observed activity (# of people observed)	# of people observed	other	NA	89978	NA	Field
Evidence of primary contact recreation (1=observed, 0=not observed)	NU	other	NA	89979	NA	Field

1 Reporting to be consistent with SWQM guidance and based on measurement capability.
2 Parameters for pools to be reported only if pooled conditions are sampled as outlined under the TCEQ Interim Guidance for Routine Surface Water Quality Monitoring During Extended Drought.

References for Table A7.1a:

- United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020
- American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, (or most recent version)
- TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures Manual, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, August 2012 or most recent editions (RG-415)

Table A7.1b - Measurement Performance Specifications for Routine Systematic Monitoring Events – Flow Parameters

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	Lab
Flow Stream, Instantaneous	cfs	water	TCEQ SOP, V1	00061	Field
Flow Method (1-gage, 2-electric, 3-mechanical, 4-weir/flume, 5-doppler)	NU	water	TCEQ SOP, V1	89835	Field
Flow severity (1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry)	NU	water	TCEQ SOP, V1	01351	Field
Stream Flow Estimate (CFS)	cfs	water	TCEQ SOP, V1	74069	Field

References for Table A7.1b:

- United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020
- American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, (or most recent version)
- TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures Manual, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, August 2012 or most recent editions (RG-415)

Table A7.1c - Measurement Performance Specifications for Routine Systematic Monitoring Events – Conventional Parameters in Water

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	AWRL	LOQ	LOQ CHECK STD %Rec	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
Residue, Total nonfiltrable (TSS)	mg/L	water	SM 2540 D	00530	4	1	NA	NA	NA	Eastex
Nitrogen, Ammonia, Total (mg/L as N)	mg/L	water	SM4500 NH3 G	00610	0.1	0.1	70-130	20	80-120	Eastex
Nitrogen, Kjeldahl, Total (mg/L as N)	mg/L	water	SM 4500 – Norg B or C and SM4500-NH_3 C	00625	0.2	0.2	70-130	20	80-120	Eastex
Nitrogen, Nitrate, Total (mg/L as N)	mg/L	water	EPA 300.0	00620	0.05	0.05	70-130	20	80-120	Eastex
Nitrogen, Nitrite, Total (mg/L as N)	mg/L	water	EPA 300.0	00615	0.05	0.05	70-130	20	80-120	Eastex
Nitrite+Nitrate, total (mg/L as N) [one lab determined value]	mg/L	water	SM 4500 – NO3 F	00630	0.05	0.02	70-130	20	80-120	Eastex
Phosphorus, Total, Wet Method (mg/L as P)	mg/L	water	SM 4500-PE	00665	0.06	0.02	70-130	20	80-120	Eastex
Orthophosphate phosphorus, diss, mg/L, Field Filtered <15 min	mg/L	water	EPA 300.0 or SM 4500-P E	00671	0.04	0.04	70-130	20	80-120	Eastex
Orthophosphate phosphorus, diss, mg/L, Filtered >15 min	mg/L	water	EPA 300.0 or SM 4500-P E	70507	0.04	0.04	70-130	20	80-120	Eastex

References for Table A7.1b:

- United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020
- American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition or most recent version
- TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures Manual, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, August 2012 or most recent editions (RG-415)

Table A7.1d - Measurement Performance Specifications for Routine Systematic Monitoring Events – Bacteriological Parameters in Water

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	AWRL	LOQ	LOQ CHECK STD %Rec	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
E. coli, , Colilert, IDEXX method MPN/mL	MPN/100 mL	water	Colilert-18[2]	31699	1	1	NA	0.5[1]	NA	Eastex
E. coli, Colilert, IDEXX, holding time	hours	other	NA	31704	NA	NA	NA	NA	NA	Eastex

1 This value is not expressed as a relative percent difference. It represents the maximum allowable difference between the logarithm of the sample result and the logarithm of the duplicate result. See Section B5.

2 *E.coli* samples analyzed by IDEXX Colilert-18 should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.

References for Table A7.1c:

- United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020
- American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Online Edition,(or most recent version)
- TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures Manual, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, August 2012 most recent editions (RG-415)

Precision

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. It is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions, and is an indication of random error.

Laboratory precision is assessed by comparing replicate analyses of laboratory control samples in the sample matrix (e.g. deionized water, sand, commercially available tissue) or sample/duplicate pairs in the case of bacterial analysis. Precision results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for precision are defined in Tables A7.1c-d.

Bias

Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is determined through the analysis of laboratory control samples and LOQ check samples prepared with verified and known amounts of all target analytes in the sample matrix (e.g. deionized water) and by calculating percent recovery. Results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for laboratory control standards are specified in Tables A7.1c-d.

Representativeness For Routine Sampling

Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring*, and use only of approved analytical methods will assure that the measurement data represents the conditions at the monitoring sites. Representativeness will be measured with the completion of sample collection in accordance with the approved QAPP.

Routine data collected for the project and submitted to TCEQ for water quality assessments is performed on a routine frequency. At a minimum, samples will be collected over at least two seasons (to include inter-seasonal variation) and will include some data collected during an index period (March 15 thru October 15). Routine systematic water quality data are collected on a bi-monthly frequency and are separated by approximately even time intervals or 30 days. The data sets collected during routine monitoring will not be biased toward unusual conditions of flow, runoff, or season.

Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project(s) that 90% data completion is achieved.

Comparability

Confidence in the comparability of routine data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and in the most recent version of the TCEQ SWQM SOPs. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in the format required for submission to SWQMIS.

Laboratory measurement quality control requirements and acceptability criteria are provided in Section B5.

A8 SPECIAL TRAINING/CERTIFICATION

Monitoring staff personnel receive training in proper sampling and field data collection. Before independent sampling or data collection occurs, staff demonstrate to the Field Operations Supervisor (or designee) their ability to properly calibrate field equipment and perform field sampling and data collection procedures. Field personnel training is documented and retained in the Training Records file maintained by H-GAC's QAO. The documentation is available during monitoring systems audits.

Contractors and subcontractors will ensure that laboratories analyzing samples under this QAPP meet the requirements contained in The NELAC Institute TNI Standards (2009) Volume 1, Module 2, Section 4.5.5 (concerning Subcontracting of Environmental Tests).

A9 DOCUMENTS AND RECORDS

The documents and records that describe, specify, report, or certify activities are listed In Table A9.1. All records are kept for a minimum of seven years after the end of the project.

Table A9.1a Project Documents and Records for AgriLife

Document/Record	Location	Retention*	Format
QAPPs, amendments and appendices	AgriLife	7 years	Paper/ Electronic
QAPP distribution documentation	AgriLife	7 years	Paper
Field data sheets (copies)	AgriLife	7 years	Paper
Field instrument print outs (copies)	AgriLife	7 years	Paper/Electronic
Field equipment calibration/ maintenance logs (copies)	AgriLife	7 years	Paper
Chain of custody records (copies)	AgriLife	7 years	Paper
Corrective Action Documentation	AgriLife	7 years	Paper

*Retention period in paper format/electronic format.

Table A9.1b Project Documents and Records for H-GAC

Document/Record	Location	Retention*	Format
QAPPs, amendments and appendices	H-GAC	7 years	Paper/ Electronic
QAPP distribution documentation	H-GAC	7 years	Paper
Field data sheets	H-GAC	7 years	Paper
Field instrument print outs	H-GAC	7 years	Paper/Electronic
Field staff training records	H-GAC	7 years	Paper
Field equipment calibration/maintenance logs	H-GAC	7 years	Paper
Chain of custody records	H-GAC	7 years	Paper
Field SOPs	H-GAC	7 years	Paper
Corrective Action Documentation	H-GAC	7 years	Paper/Electronic

*Retention period in paper format/electronic format.

Table A9.1c Project Documents and Records for Eastex Lab

Document/Record	Location	Retention*	Format
QAPPs, amendments and appendices	H-GAC	7 years	Paper/Electronic
Chain of custody records	Eastex	7 years	Paper
Laboratory QA Manuals	Eastex	7 years	Paper/Electronic
Laboratory SOPs	Eastex	7 years	Paper/Electronic
Laboratory data reports/results	Eastex	7 years	Paper
Laboratory staff training records	Eastex	7 years	Paper
Instrument printouts	Eastex	7 years	Paper
Laboratory equipment maintenance logs	Eastex	7 years	Paper
Laboratory calibration records	Eastex	7 years	Paper
Corrective Action Documentation	Eastex	7 years	Paper/Electronic

*Retention period in paper format/electronic format.

All H-GAC records, including notebooks, binders, and electronic files of technical staff, will be archived by H-GAC for at least seven years after the end of the project. Electronic data are stored on the network servers. The network servers are backed up nightly. After one week, data tapes are sent off-site to an electronic storage warehouse where they are held for 8 weeks. At the end of that 8 week period, the tapes are sent back to H-GAC to be re-used to back-up the servers again and the cycle begins again. In the event of a catastrophic systems failure, the tapes can be used to restore the lost data. Data generated on the day of the failure may be lost, but can be reproduced from raw data in most cases.

The TSSWCB may elect to take possession of records at the conclusion of the specified retention period.

Laboratory Test Reports

Test/data reports from the laboratory will document the test results clearly and accurately. Reporting of the data will follow standard formats and protocols for *TNI Standards (2009) Volume 1 Module 2 Section 5.10* and include the information necessary for the interpretation and validation of data. If needed for alternate types of reporting by TSSWCB, requirements and procedures for reporting data are provided below.

Eastex is the contract lab for H-GAC's monitoring program. The final lab data for H-GAC's program are submitted by Eastex directly to H-GAC's Data Manager. It is reformatted as needed and validated prior to submission to the TSSWCB PM. Eastex lab reports are generated to include the following information but not all of this information is sent to H-GAC but is available upon request;

1) The title "Test Report" or other identifying statement (the lab offers several report formats);
2) Name and address of laboratory, and phone number with name of contact person;

3) A unique identification number and the total number of pages, with all pages sequentially numbered;
4) Name and address of client;
5) Description and unambiguous identification of the sample(s) including the client identification code (i.e. station information);
6) Identification of results for any sample that did not meet sample acceptance requirements per A7.1 tables;
7) Date and time of receipt of sample, date and time of sample collection, sample matrix, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 30 hours;
8) Identification of the test method used plus its LOQ and LOD;
9) Reference to sampling procedure (grab or composite);
10) Any deviations from, additions to or exclusions from SOPs, and any conditions that may have affected the quality of results, and including the use and definitions of data qualifiers;
11) Measurements, examinations and derived sample results, supported by tables, graphs, sketches and photographs as appropriate, and any failures identified; identification of whether data are calculated on a dry weight or wet weight basis; identification of the reporting units such as µg/l or mg/kg;
12) Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.;
13) Clear identification of numerical results with values below the Reporting Limit, and
14) Identification of accreditation status per analysis.

Electronic Data

Data will be submitted electronically to the TCEQ Data Management and Analysis Team and/or project partner for review in the Event/Result file format. A completed Data Summary (see example in Appendix D) will be submitted with each data submittal.

A9.2 Codes for Data Submittals

Sample Description	Tag Prefix	Submitting Entity	Collecting Entity	Monitoring Type Code
Routine monitoring	*TX*	*TX*	*HG*	*RTWD*

Revisions and Amendments to the QAPP

Until the work described is completed, this QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. The last approved version of the QAPP shall remain in effect until a revised version has been fully approved; the revision must be submitted to the TSSWCB for approval before the last approved version has expired. If the entire QAPP is current, valid, and accurately reflects the project goals and the organization's policy, the annual re-issuance may be done by a certification that the plan is current. This will be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

Amendments to the QAPP may be necessary to address incorrectly documented information or to reflect changes in project organization, tasks, schedules, objectives, and methods; address deficiencies and nonconformance; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests for amendments will be directed from the AgriLife Project Manager to the TSSWCB Project Manager electronically. Amendments are effective immediately upon approval by the

AgriLife Project Manager, H-GAC Project Manager, H-GAC Project QAO, the TSSWCB Project Manager, the TSSWCB QAO and the Eastex QAO (if applicable). They will be incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list by the H-GAC Project Manager or designee. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process.

B1 SAMPLING PROCESS DESIGN

The sample design was developed to provide critical data and information necessary for supporting the implementation of a watershed protections plan for Mill Creek. After utilizing historical knowledge of the watershed, conducting a reconnaissance of the watershed, and review of data results collected during the development of the WPP, project participants devised a sampling plan to ensure a representative water monitoring strategy within the watershed as related to implementation efforts. In this project, routine systematic monitoring is still designed to evaluate water quality during a variety of spatial, seasonal and meteorological conditions. The water quality data and evaluations of water quality conditions will be communicated to the public and the Mill Creek stakeholders to support adaptive management of the Mill Creek WPP and expand public knowledge of Mill Creek water quality data.

Routine data collected from Mill Creek, the East and West Forks of Mill Creek and two other tributaries will be used to support implementation of the approved watershed protection plan for Mill Creek. This data will also be submitted to the TCEQ for storage in SWQMIS. Achievable water quality objectives and priorities and the identification of water quality issues were used to develop the work plan, in accordance with available resources.

All data collection efforts will use monitoring procedures consistent with the TCEQ SWQM program and results will be provided to TCEQ, via TSSCWB, for inclusion in the statewide database maintained by TCEQ. Outlined below are some of the general guidelines discussed thoroughly in the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring* and followed when selecting sampling sites for the project. Overall consideration is given to accessibility and safety. All monitoring activities have been developed with the TSSWCB project #16-11 in mind.

1. Locate stream sites so that samples can be safely collected from the centroid of flow. Centroid is defined as the midpoint of that portion of stream width which contains 50 percent of the total flow. If few sites are available for a stream segment, choose one that would best represent the water body, and not an unusual condition or contaminant source. Avoid backwater areas or eddies when selecting a stream site.

2. Because historical water quality data can be very useful in assessing use attainment or impairment, sampling stations with current or past monitoring data have higher preference in selection criteria.

3. Routine monitoring sites were selected to characterize water quality within UGSG Hydrological Units delineated on a subwatershed level (with only slight modifications) so data may be used in future modeling efforts.

Sites should be accessible. Flow measurement will be made during all monitoring events unless unsafe conditions exist.

See Tables A6.1 and A7.1a-d for sampling process design information and monitoring tables associated with data collected under this QAPP.

Table B1.1 Monitoring Stations and Sampling Process Design

Site	Site-ID	TCEQ Station ID	Latitude Decimal	Longitude Decimal	Description	Seg ID	Collected By	Monitor Type	Bacteria	Conven-tionals	Flow	Field
8	EMC-4	21585	30.039449	-96.413137	East fork Mill Creek at Bleiblerville Rd. About 1.5 km northwest of TCEQ station ID 20133.	1202K	HG	RTWD	6	6	6	6
7	EMC-6	21584	29.959612	-96.320151	East fork Mill Creek at FM 159/Old Nelsonville Rd, 1.5 km west of intersection of Koy Rd and FM 159.	1202K	HG	RTWD	6	6	6	6
6	WMC-4a	21582	29.9557127	-96.4276336	West Mill Creek at Tiemann Rd, east of Industry.	1202K	HG	RTWD	6	6	6	6
5	WMC-6	21581	29.935733	-96.360328	West fork Mill Creek adjacent to small lake between Artists Cir Dr and John Schoelikopf Rd approximately 7.7 km west of the Mill Creek Rd and Kuykendall Rd	1202K	HG	RTWD	6	6	6	6
4	SSC-1	21580	29.921135	-96.301334	Sandy Creek at Mill Creek Rd southwest of Bellville	TBD	HG	RTWD	6	6	6	6
3	20131-A	21579	29.896756	-96.254975	Mill Creek at FM 2429 5.13 km upstream of SH 36 and 5.25 km downstream of Mill Creek Road at approximately 5.78 km south of the City of Bellville in Austin County	1202K	HG	RTWD	6	6	6	6
2	BC-1	22013	29.909526	-96.251110	Boggy Creek at FM 2429 in Austin County	1202K	HG	RTWD	6	6	6	6
1	MC-2	21577	29.869637	-96.155232	Mill Creek at FM331, immediately downstream of bridge.	1202K	HG	RTWD	6	6	6	6

1) RT^2 - Sampling scheduled in advance without intentionally trying to target any certain environmental condition. The sampling seeks to set a baseline for the site. Sample will be collected regardless of the conditions encountered.

Eight routine monitoring sites were selected to provide spatial distribution of data in the watershed. (See Table B1.1.) These sites were selected based upon input from local residents regarding the year round presence of water and WPP implementation activities. Bi-monthly routine monitoring at each site includes field, conventional, and bacterial parameter groups. Analytical results will be used to characterize water quality throughout the watershed. There may be times, during dry weather conditions, when there is no water in the stream in some of the subwatersheds. Those visits will be documented but no water quality samples will be collected. During periods when water is not flowing, a flow severity of either No Flow (1) or Dry (6) will be recorded and reported. In addition, when pooled conditions exist, an Instantaneous Flow for parameter 00061 will be reported as 0. When the stream is dry, no result is reported for parameter 00061. If waters are pooled at a station, not flowing, and pools meet guidelines as outlined in the TCEQ *Interim Guidance for Routine Surface Water Quality Monitoring During Extended Drought*, water samples will be collected and analyzed as routine samples. The additional parameters of maximum pool width, maximum pool depth, pool length, and % pool coverage in 500 meter reach will also be reported. Routine monitoring in this project will complement existing routine ambient monitoring being conducted by TCEQ.

Lab Parameters for the various monitoring events are listed in Table B1.2 below. The parameters were chosen to get the most relevant tests analyzed for the various scenarios while maximizing the budget.

Table B1.2 – Lab Parameter List for Various Monitoring Activities

Bi-monthly sampling (full suite of lab parameters)
TSS
Nitrogen, Ammonia, Total (mg/L)
Nitrogen, Kjeldahl, Total (mg/L)
Nitrogen, Nitrate, Total (mg/L)
Nitrogen, Nitrite, Total (mg/L)
Nitrite+Nitrate-N, (mg/L) [alternate – one total lab determined value]
Phosphorus, Total, Wet Method (mg/L)
Orthophosphate phosphorus, dissolved, mg/L, Field Filtered <15 min
Orthophosphate phosphorus, dissolved, mg/L, Filtered >15 min [alternate]
E. coli, Colilert, IDEXX method MPN/mL
E. coli, Colilert, IDEXX, holding time

B2 SAMPLING METHODS

Field Sampling Procedures

Field sample and data collection will be conducted according to procedures documented in the most current version of *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring*. Specifications outlined in Table B2.1 reflect additional requirements for sampling for the project and/or provide additional clarification.

Table B2.1 Sample Storage, Preservation and Handling Requirements for H-GAC. Samples Analyzed at Eastex Environmental Laboratory

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
TSS	water	Plastic	Cool to 4°C	1 L	7 days
E. coli IDEXX Colilert	water	Sterile Plastic w/ sodium thiosulfate	Cool to <6°C but not frozen	120 mL	8 hours[1]
TKN	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	500 mL[2]	28 days
Ammonia-N	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	125 mL[2]	28 days
Nitrate	water	Plastic	Cool to 4°C	125 mL[3]	48 hours
Nitrite	water	Plastic	Cool to 4°C	125 mL[3]	48 hours
Nitrite + nitrate-N (alternate)	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	125 mL[2]	28 days
Phosphorus-P, total	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	125 mL[2]	28 days
Orthophosphate Phosphorus[4]	water	Plastic	Cool to 4°C	250 mL	48 hours

[1] *E.coli* samples analyzed by IDEXX Colilert-18 should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.
[2] Four tests are analyzed from one 1L plastic bottle.
[3] Two tests will be performed from one 250 mL bottle.
[4] Orthophosphate Phosphorus is field filtered as first preference. Non-field filtered STORET code is backup.

Sample Containers

Certificates from sample container manufacturers are maintained in a notebook by Eastex Lab as appropriate. Information about the various sample containers is described below.

All sample containers are provided to H-GAC by a contract lab, Eastex. The lab performs and tracks required QC procedures for all bottles purchased.

- Pre-cleaned, plastic, disposable sample containers are used for conventional parameters.
- Sterile, sealed, 120 mL plastic, disposable bottles with a sodium thiosulfate tablet added, are used for bacteriological samples.
- A new disposable, 0.45 micron capsule filters is used at every monitoring site for samples requiring field filtration.
- The tubing used by H-GAC to field filter ortho phosphate phosphorus samples is re-used. H-GAC's contract lab (Eastex) cleans the tubing between each use by washing each piece with a

10 % nitric acid solution and a 10% Hydrochloric acid solution. Each tube is triple rinsed with D.I. water between and after the 2 acid washes, then hung and allowed to air dry. The lab individually packages each tube in a zip-lock style, plastic baggie and performs QC testing to assure that no contamination results from the washing procedure.

- When preservation is required for particular parameters, the acid is added to the container in the field by field personnel immediately after samples are collected and always within 15 minutes.

Processes to Prevent Contamination

Procedures in the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring* outline the necessary steps to prevent contamination of samples, including direct collection into sample containers, when possible. Field QC samples (identified in Section B5) are collected to verify that contamination has not occurred.

Documentation of Field Sampling Activities

Field sampling activities are documented on field data sheets (see Appendix A). The following will be recorded for all visits:

- station ID
- sampling date
- sampling time
- sampling depth
- sample collector's name/signature
- values for all field parameters, including flow and flow severity
- detailed observational data, where appropriate, including:
  - water appearance
  - weather
  - biological activity
  - unusual odors
  - pertinent observations related to water quality or stream uses (i.e., exceptionally poor water quality conditions; stream uses such as swimming, boating, fishing, irrigation pumps)
  - watershed or instream activities (i.e., bridge construction, livestock watering upstream)
- missing parameters (i.e., when a scheduled parameter or group of parameters is not collected)

Recording Data

For the purposes of this section and subsequent sections, all field and laboratory personnel follow the basic rules for recording information as documented below:

- Legible writing in indelible ink with no modifications, write-overs or cross-outs;
- Correction of errors with a single line followed by an initial and date;
- Close-out on incomplete pages with an initialed and dated diagonal line.

Sampling Method Requirements or Sample Processing Design Deficiencies and Corrective Action

Examples of sampling method requirements or sample design deficiencies include but are not limited to such things as inadequate sample volume due to spillage or container leaks, failure to preserve samples appropriately, contamination of a sample bottle during collection, storage temperature and holding time exceedance, sampling at the wrong site, etc. Any deviations from the QAPP and appropriate sampling procedures may invalidate resulting data and may require corrective action. Corrective action may include for samples to be discarded and re-collected. It is the responsibility of the H-GAC Project Manager, in consultation with the H-GAC Project QAO, to ensure that the actions and resolutions to problems are documented by completion of a corrective action report (CAR) and that records are maintained in accordance with this QAPP. In addition, these actions and resolutions will be conveyed to the AgriLife Project Manager who will inform the TSSWCB Project Manager in writing in the project progress reports.

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

B3 SAMPLE HANDLING AND CUSTODY

Sample Tracking

Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, and analysis.

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The Chain of Custody (COC) form is a record that documents the possession of the samples from the time of collection to receipt in the laboratory. The following information concerning the sample is recorded on the COC form (See Appendix B).

- Date and time of collection
- Site identification
- Sample matrix, indicated by the test group code
- Number of containers and container type ID designation
- Preservative used or if the sample was filtered, indicated by test group code
- Analyses required, indicated by the test group code
- Name of collector
- Custody transfer signatures and dates and time of transfer
- Name of laboratory accepting the sample

Sample Labeling

Samples from the field are labeled on the container with an indelible marker. Label information includes:

- Site identification
- Date of sampling
- Time of sampling

- Preservative added, if applicable

Sample Handling

After collection of samples is complete, sample containers are immediately immersed in ice in an ice chest for transport to the Eastex laboratory. Ice chests remain in the possession of the field technician or in the locked vehicle until being delivered to the lab. After submission to the Eastex laboratory courier, the samples remain in the log-in room until log-in is completed, then they are stored in the refrigeration unit or given to an analyst for immediate analysis. Only authorized laboratory personnel handle samples received by the laboratory. Eastex Environmental Laboratory Quality Manual (QM), most current version, addresses samples relinquished to the lab.

Sample Tracking Procedure Deficiencies and Corrective Action

All deficiencies associated with COC procedures and described in this QAPP are immediately reported to the H-GAC Project Manager or QAO. These include such items as delays in transfer resulting in holding time violations; violations of sample preservation requirements; incomplete documentation, including signatures; possible tampering of samples; and broken or spilled samples. The H-GAC Project Manager, in consultation with the AgriLife PM and H-GAC Project QAO, will determine if the procedural violation may have compromised the validity of resulting data. Any failures that have reasonable potential to compromise data quality will invalidate data, and the sampling event should be repeated, if feasible. The resolution of the situation will be reported to the TSSWCB Project Manager in the project progress report. CARs will be prepared by the H-GAC personnel and summarized by the H-GAC PM for submittal to the AgriLife Project Manager for inclusion with project progress report.

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

B4 ANALYTICAL METHODS

The analytical methods, associated matrices, and performing laboratories are listed in Table A7.1 of Section A7. The procedures for laboratory analysis shall be in accordance with the most recently published edition of Standard Methods for the Examination of Water and Wastewater, the latest version of the TCEQ Surface Water Quality Monitoring Procedures, 40 CFR Part 136, or other reliable procedures acceptable to the TSSWCB.

Laboratories collecting data under this QAPP are compliant with the NELAC® standards, at a minimum. Copies of laboratory SOPs are available for review by the TSSWCB.

Standards Traceability

All standards used in the field and laboratory are traceable to certified reference materials. Standards preparation is fully documented and maintained in a standards log book. Each documentation includes information concerning the standard identification, starting materials, including concentration, amount used and lot number; date prepared, expiration date and preparer's initials/signature. Reagent bottles are labeled to trace the reagent back to preparation. Table A7.1, Measurement Performance Specifications, lists the methods to be used for field and laboratory analyses.

Deficiencies, Nonconformances and Corrective Action Related to Quality Control

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to field and laboratory measurement systems include, but are not limited to, instrument malfunctions, blank contamination, and QC sample failures.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the pertinent field or laboratory supervisor who will notify the H-GAC Project Manager. A Corrective Action Report to document the deficiency is written for each deficiency.

The H-GAC Project Manager, in consultation with the AgriLife PM and H-GAC Project QAO (and other affected individuals/organizations), will determine whether the deficiency could affect data quality. If it is determined the item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined a nonconformance does exist, the H-GAC Project Manager, in consultation with the AgriLife PM and H-GAC Project QAO, will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented in the CAR (see Appendix E).

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

The TCEQ has determined that analyses associated with the qualifier codes (e.g. “holding time exceedance”, “sample received unpreserved”, “estimated value”) may have unacceptable measurement uncertainty associated with them. Therefore, data with these types of problems shall be clearly qualified prior to submittal to the TCEQ Data Management and Analysis Team. Additionally, any data collected or analyzed by means other than those stated in the QAPP, or data suspect for any reason shall be appropriately qualified (see SWQM DMRG December 2016 or most recent version for data qualifiers). TCEQ will review the data and load data approved by the TSSWCB Project Manager into SWQMIS.

B5 QUALITY CONTROL

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Batch
A batch is defined as environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAP-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 25 hours. An **analytical batch** is composed of prepared environmental samples (extract, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Method Specific QC requirements
QC samples, other than those specified in this section (i.e., sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples, positive control, negative control,

and media blank), are analyzed as specified in the methods. The requirements for these samples, their acceptance criteria or instructions for establishing criteria, and corrective actions are method-specific.

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory SOPs. The minimum requirements to which all participants abide by are stated below.

Comparison Counting

For routine bacteriological samples, repeat counts on one or more positive samples are required, at least monthly. If possible, compare counts with an analyst who also performs the analysis. Replicate counts by the same analyst should agree within 5 percent, and those between analysts should agree within 10 percent. Record the results.

Limit of Quantitation (LOQ)

The laboratory will analyze a calibration standard (if applicable) at the LOQ on each day calibrations are performed. In addition, a LOQ check sample will be analyzed with each analytical batch. Calibration results, including the standard at the LOQ listed in Table A7.1c-d, will meet the calibration requirements of the analytical method or corrective action will be implemented.

LOQ Check Sample

A LOQ check sample consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. The LOQ check sample is carried through the complete preparation and analytical process and run at a rate of one per analytical batch. It is used to establish intra-laboratory bias to assess the performance of the measurement system at the lower limits of analysis.

The LOQ check sample is spiked into the sample matrix at a level less than or near the LOQ for each analyte in each analytical batch of samples analyzed. If it is determined that sample results exceeded the high range of the calibration curve, samples should be diluted or run on another curve. For samples run on batches with calibration curves that do not include the LOQ, a check sample will be run at the low end of the calibration curve.

The percent recovery of the LOQ check sample is calculated using the following equation in which %R is percent recovery, SR is the sample result, and SA is the reference concentration for the check sample:

$$\%R = SR/SA * 100$$

Measurement performance specifications are used to determine the acceptability of LOQ check sample analyses as specified in Table A7.1.

Laboratory Control Sample (LCS)

A LCS consists of a sample matrix (e.g. deionized water) free from the analytes of interest spiked with verified known amounts of analyte. It is used to establish intra-laboratory bias to assess the performance of the measurement system. The LCS is spiked into the sample matrix at a level less than or equal to the mid-point of the calibration curve for each analyte. In cases of test methods with very long lists of analytes, LCSs are prepared with all the target analytes and not just a representative number. The LCS is carried through the complete preparation and analytical process and run at a rate of one per batch.

Results of LCSs are calculated by percent recovery (%R), which is defined as 100 times the measured concentration, divided by the true concentration of the spiked sample. The following formula is used to calculate percent recovery, where %R is percent recovery; SR is the measured result; and SA is the true result:

$$\%R = SR/SA * 100$$

Measurement performance specifications are used to determine the acceptability of LCS analyses as specified in Table A7.1.

Laboratory Duplicates

A laboratory duplicate is an aliquot taken from the same container as an original sample under laboratory conditions and processed and analyzed independently. A laboratory control sample duplicate (LCSD) is prepared in the laboratory by splitting aliquots of an LCS. Both samples are carried through the entire preparation and analytical process. LCSDs are used to assess precision and are performed at a rate of one per batch.

For most parameters, except bacteria, precision is evaluated using the relative percent difference (RPD) between duplicate LCS results as defined by 100 times the difference (range) of each duplicate set, divided by the average value (mean) of the set. For duplicate results, X1 and X2, the RPD is calculated from the following equation:

$$RPD = |(X1 - X2)/\{(X1+X2)/2\} * 100|$$

For bacteriological parameters, precision is evaluated using the results from laboratory sample duplicates. Bacteriological duplicate are collected on a 10% frequency (or once per sampling run, whichever is more frequent). These duplicates will be collected in sufficient volume (200 mL or more) for analysis of the sample and its laboratory duplicate from the same container.

The base-10 logarithms of the results from the original sample and its duplicate are calculated. The absolute value of the difference between the two logarithms will be compared to the precision criterion in Tables A7.1b-d. If the difference in logarithms is greater than the precision criterion, the data are not acceptable for use under this project and will not be reported to TSSWCB. Results from all samples associated with that failed duplicate (usually a maximum of 10 samples) will be considered to have excessive analytical variability and will be qualified as not meeting project QC requirements.

The precision criterion in Tables A7.1d for bacteriological duplicates applies to only samples with concentrations > 10 MPN/100 mL. Field splits are not collected for bacteriological analyses.

Matrix spike (MS)

Matrix spikes are prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. The components to be spiked shall be specified by the mandated analytical method. The results from matrix spikes are primarily designed to assess the validity of analytical results in a given matrix, and are expressed as percent recovery (%R).

Matrix spikes indicate the effect of the sample on the precision and accuracy of the results generated using the selected method. The frequency of matrix spikes is specified by the analytical method, or a

minimum of one per preparation batch, whichever is greater. To the extent possible, matrix spikes prepared and analyzed over the course of the project should be performed on samples from different sites.

The percent recovery of the matrix spike is calculated using the following equation, where %R is percent recovery, SSR is the concentration measured in the matrix spike, SR is the concentration in the unspiked sample and SA is the concentration of analyte that was added:

$$\%R = (SSR - SR)/SA * 100$$

Matrix spike recoveries are compared to the acceptance criteria published in the mandated test method. Where there are no established criteria, the laboratory shall determine the internal criteria and document the method used to establish the limits. Eastex uses matrix spike recovery limits of 80-120 for parameters where a spike solution is available. These recoveries are monitored with QC charts to help determine interferences or detect trends. Matrix spikes that fail to meet these guidelines are reanalyzed if possible. An alternate sample may be used to help determine whether the problem was specific to that sample. If matrix spikes are not achievable within 80-120 % recovery then this recovery is flagged as exceeding the control limit on the QC report.

Method blank

A method blank is a sample of matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as the samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. The method blanks are performed at a rate of once per preparation batch. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the LOQ. For very high-level analyses, the blank value should be less than 5% of the lowest value of the batch, or corrective action will be implemented. Samples associated with a contaminated blank shall be evaluated as to the best corrective action for the samples (e.g., reprocessing or data qualifying codes). In all cases the corrective action shall be documented.

The method blank shall be analyzed at a minimum of one per preparation batch. In those instances for which no separate preparation method is used (example: volatiles in water) the batch shall be defined as environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

Deficiencies, Nonconformances and Corrective Action Related to Quality Control

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies that affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to QC include but are not limited to field and laboratory QC sample failures.

Deficiencies are documented in logbooks, field data sheets, etc., by field or laboratory staff and reported to the appropriate field or laboratory supervisor who will notify the H-GAC Project Manager. The H-GAC Project Manager will notify the AgriLife QAO of the potential nonconformance. The H-GAC QAO will initiate a CAR to document the deficiency.

The AgriLife Project Leader or Co-Leader, in consultation with H-GAC Project QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is

determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and the CAR closed. If it is determined a nonconformance does exist, the AgriLife Project Manager in consultation with the AgriLife QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the AgriLife QAO by completion of a CAR (see Appendix E).

CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to AgriLife and TSSWCB both verbally and in writing.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

All sampling equipment testing and maintenance requirements are detailed in the *TCEQ Surface Water Quality Monitoring Procedure: Volume 1*. Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory SOPs.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

Field equipment calibration requirements are contained in the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring*. Post-calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidate associated data collected subsequent to the pre-calibration and are not submitted to the TCEQ Data Management and Analysis Team.

Detailed laboratory calibrations are contained within the laboratory QM and SOPs.

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Chemicals for analysis are tested by the supplier and meet or exceed ACS certification, where applicable. All supplies and consumables received by Eastex Laboratory are inspected upon receipt for damage, missing parts, expiration dates, and storage and handling requirements by appropriate laboratory personnel. Labels on reagents, chemicals, and standards are examined to ensure they are of appropriate quality, initialed by staff member and marked with receipt date. Volumetric glassware is inspected to ensure class "A" classification, where required. All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory SOPs.

B9 NON-DIRECT MEASUREMENTS

Non-directly measured data, secondary data, or acquired data involves the use of data collected under another project, and collected with a different intended use than this project. The acquired data still meets the quality requirements of this project, and is defined below. The following data source(s) will be used for this project:

Rainfall data will be acquired from multiple sources to report parameter code 72053 (Days Since Precipitation Event) with each set of water quality data submitted to TCEQ. H-GAC will use the internet source that best addresses the rainfall events occurring closest to but upstream of or within the drainage area affecting their various monitoring stations. Historical rainfall data is accessible on these web sites to determine the "number of days since" requirement for reporting the parameter code 72053. These sites include:

- National Oceanic and Atmospheric Administration's (NOAA's) National Climatic Data Center (NCDC) (http://www.ncdc.noaa.gov/). The NCDC is responsible for preserving, monitoring, assessing, and providing public access to the nation's climate and historical weather data and information
- Weather Underground (http://www.wunderground.com/) which collects and maintains precipitation data from numerous sources in the selected area

The USGS National Water Information System (NWIS) web interface can also be used to determine when a significant change in flow occurred at the various flow gages operated around the state of Texas. The web site http://waterdata.usgs.gov/tx/nwis/current/?type=flow can display discharge data in graph or tabular format to determine days when runoff affected the stream.

Flow data from the United States Geological Survey (USGS) Station 08111700, Mill Creek near Bellville, Texas, is collocated with monitoring station 11576. Flow data from this USGS station will be used for this project. USGS gage station data will be used throughout this project to aid in determining flow through the watershed. Rigorous QA checks are completed on gage data by the USGS and the data are approved by the USGS and permanently stored at the USGS. This data may be submitted to the TCEQ under parameter code 00061 (Instantaneous Flow) or parameter code 74069 (Estimated Flow) depending on the proximity of the monitoring station to the USGS gage station.

For evaluating trends, historical data from SWQMIS will be included in the statistical dataset as well as samples collected during the study period by the TCEQ under the SWQM Program.

B10 DATA MANAGEMENT

Data Management Process

When data is submitted to H-GAC's Data Manager for 'processing', the data is saved in "Raw Data" folders. When H-GAC's Data Manager begins to process the data, it is saved into a "Working Data" folder so H-GAC always has the original data submittal in electronic format as an archive. Data is processed by H-GAC's Data Manager (a SAS Operator) and H-GAC's QAO before being submitted to

TSSWCB for review and approval. Upon approval, TSSWCB will submit the data to TCEQ's Data Management and Analysis Team in the format specified in the *SWQM Data Management Reference Guide*, December 2016 or most recent version, for additional review and formatting approval. H-GAC's full data procedure is described in Appendix F – Data Management Process.

H-GAC's field sheets are kept in a three ring binder at the Data Manager's desk or in a designated location accessible to all field personnel. The calibration sheets, field sheets, and COCs are reviewed by the QAO before any data entry is made. If there are nonconformances such as failed calibration, the QAO writes instructions in a different colored ink on the related field sheet regarding data entry. Then the instructions are initialed and dated.

Electronic data from datasondes and flow-measurement devices are downloaded into a raw data folder and printed out to be attached to field sheets. These electronic files are imported into an Access database. Field data is entered in this Access database by the H-GAC Data Manager and saved in a secured network drive ("Working Data"). It is reviewed for accuracy and completeness by either the H-GAC Data Manager or QAO (but not the person who performed the original data entry). When associated lab data is received from the lab, the electronic files are also saved in the "RAW Data" folder. The Access database in the "working" file becomes the input file for SAS processing.

SAS code has been written to process both the field and laboratory datasets. Following initial SAS processing and investigation of flagged records, a draft Data Summary is compiled by the H-GAC DM. Details of any data changes are documented in the Data Summary. All SAS output is saved on secured network drives that are backed up regularly by IT staff. The DM provides the QAO with the draft Data Summary for review. The H-GAC QAO review of the datasets and the Data Summary is documented and provided to the H-GAC DM for further investigation, verification, or change. This record of the QAO review is retained with the data review package. See H-GAC's Data Management Flow Chart in Appendix C to see the various tables and Flagged Records reports that are created during the data review process.

Data Dictionary - Terminology and field descriptions are included in the *SWQM Data Management Reference Guide*, December 2016 or most recent version. The following table contains the codes used by H-GAC when submitting data under this QAPP. The parameters associated with each sample and the sampling frequency by station are presented in Tables A7.1a-d.

Table B10.1 –Sampling Entity Data Submission Codes

Name of Monitoring Entity	Tag Prefix	Submitting Entity	Collecting Entity
Houston-Galveston Area Council	TX	TX	HG

Data Errors and Loss

H-GAC stores original electronic data as "Raw Data" files. These files are saved in the original format and other than changing the name of a file, remains unchanged. Any changes to a data file are saved in the "Working Data" folders. In these folders, data is merged, formatted, and converted to the correct reporting units before SAS processing begins. After SAS is applied, the files are stored in ACCESS tables. An ACCESS database is made for each data set. In this database, there are several folders where all reports and modifications are documented. There is an INPUT folder, an OUTPUT folder, Draft

Matrix tables which should show all the data as reformatted and ready to be converted into the EVENT/RESULTS format for TCEQ. All changes, validation, and verification actions on the data are documented in a Data Review Summary Report which accompanies each data set submittal (Appendix D).

Copies of e-mails and communications with partners are printed and attached to the data set for traceability.

H-GAC water samples are sent to Eastex Lab for analysis. Field data sheets are collected by the Data Manager for input to an Access Database, review for outliers, and reasonableness. H-GAC's QAO reviews the data for transcription accuracy and reasonableness. A Data Summary Sheet is submitted to TCEQ Data Management and Analysis Team with each data set.

Details of the Eastex *Data Reduction and Review* is described in the Laboratory's Quality Assurance Manual, (most current version), Sections 8.1.

Record Keeping and Data Storage

As each data set is processed by H-GAC, all hard copies of data and/or field forms are organized into packets. All correspondences or reports related to the data set are to be printed and placed in the packet of information. Including but not limited to the QAO review comments, the draft and final Data Summary Reports/Sheets. Any other documentation related to that specific data set is also to be attached. Each packet of information is placed in a file storage box for long term storage.

H-GAC field investigators submit electronic data along with hard copies of field sheets and COC forms to H-GAC's Data Manager. Electronic data is stored in folders on the H-GAC network as "originals" and as copies for data management, verification, and validation. Daily and weekly backups are completed on H-GAC's server. Hard copies are filed in filing cabinets or file boxes for use as needed. Data more than 2 years old is sent for off-site storage according to H-GAC procedures. All data is maintained for at least seven (7) years by H-GAC.

Copies of data submissions sent to the TCEQ Data Management and Analysis Team are kept on the H-GAC's network server. The network server is backed up nightly.

Details of the Eastex *Document Control System* is described in the Laboratory's Quality Assurance Manual, (most current version), Sections 8.4.

Data Handling, Hardware, and Software Requirements

H-GAC maintains several networked computers to store and manage water quality data. All computers are equipped with at least Microsoft Windows Based Office 2007 which includes MS Excel 2007 and MS Access 2007. The DM's computer also includes Oracle 9 to assist with screening, management and reformatting the data to TCEQ's specifications. Additionally, the SAS software is available on the DM's and another computer if an alternate SAS Operator is needed.

The laboratory database is housed on a Eastex server and backed up each evening. The LIMS runs on a Windows operating systems. Details of the Eastex *Electronic Record Storage* system is described in the Laboratory's Quality Assurance Manual, (most current version), Sections 8.4.

Information Resource Management Requirements

Data will be managed in accordance with the DMRG, and applicable H-GAC information resource management policies. H-GAC includes an Information Resource Management Department responsible for maintaining all computer hardware and software, including but not limited to servers, network accounts, data back-ups, security, firewalls, etc. Daily management is conducted along with regular maintenance and upgrades to the system.

The stations to be monitored for this project will be assigned TCEQ station IDs through TCEQ's SLOC process described in TCEQ's most current DMRG. Global Positioning System (GPS) equipment may be used as a component of the information required by the Station Location (SLOC) request process for creating the certified positional data that will ultimately be entered into the TCEQ's SWQMIS database. Positional data obtained by H-GAC staff members using a Global Positioning System will follow the TCEQ's OPP 8.11 and 8.12 policy regarding the collection and management of positional data. All positional data to be entered into SWQMIS will be collected by a GPS certified individual with an agency approved GPS device to ensure that the agency receives reliable and accurate positional data. Certification can be obtained in any of three ways: completing a TCEQ training class, completing a suitable training class offered by an outside vendor, or by providing documentation of sufficient GPS expertise and experience.

In lieu of entering coordinates collected with a Global Positioning System, positional data may be acquired using a Geographical Information System (GIS) and verified with photo interpolation using a certified source, such as USGS Digital Ortho Quarter-Quadrangles (DOQQs), Google Earth or Google Maps. The verified coordinates and map interface can then be used to develop a new station location.

C1 ASSESSMENTS AND RESPONSE ACTIONS

The following table presents the types of assessments and response actions for data collection activities applicable to the QAPP.

Table C1.1 Assessment and Response Requirements

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	H-GAC	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to AgriLife in monthly e-mails/reports
Status Monitoring Oversight, etc.	Continuous	AgriLife	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TSSWCB in Quarterly Report
Monitoring Systems Audit of H-GAC	Dates to be determined by TSSWCB	TSSWCB QAO	Field sampling, handling and measurement; facility review; and data management as they relate to the TSSWCB project #16-11	30 days to respond in writing to the TSSWCB to address corrective actions
Laboratory Inspection	Dates to be determined by TSSWCB	TSSWCB QAO	Analytical and quality control procedures employed at the Eastex laboratory	30 days to respond in writing to the TSSWCB to address corrective actions

Corrective Action Process for Deficiencies

Deficiencies are any deviation from the QAPP, *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring*, SOPs, or *the DMRG*. Deficiencies may invalidate resulting data and require corrective action. Repeated deficiencies should initiate a Corrective Action Plan (CAP). Corrective action for deficiencies may include for samples to be discarded and re-collected. Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff, are communicated to H-GAC Project Manager (or other appropriate staff), and should be subject to periodic review so their responses can be uniform and their frequency tracked. It is the responsibility of the H-GAC Project Manager, in consultation with the H-GAC QAO, to ensure that the actions and resolutions to the problems are documented and that records are maintained in accordance with this QAPP. In addition, these actions and resolutions will be conveyed to the AgriLife's Project Manager or QAO both verbally and in writing in the project progress reports and by completion of a CAP. In the event a deficiency results in qualifying data already put in SWQMIS Production, H-GAC's Data Mgr. will prepare the required documentation as specified in the DMRG Data Correction Request protocol and submit to AgriLife and TSSWCB. TSSWCB's PM will review, approve and submit the Data Correction Request to TCEQ's Data Management and Analysis Team.

Corrective Action

CAPs should:

- Identify the problem, nonconformity, or undesirable situation
- Identify immediate remedial actions if possible
- Identify the underlying cause(s) of the problem
- Identify whether the problem is likely to recur, or occur in other areas
- Evaluate the need for corrective action
- Use problem-solving techniques to verify causes, determine solution, and develop an action plan
- Identify personnel responsible for action
- Establish timelines and provide a schedule
- Document the corrective action

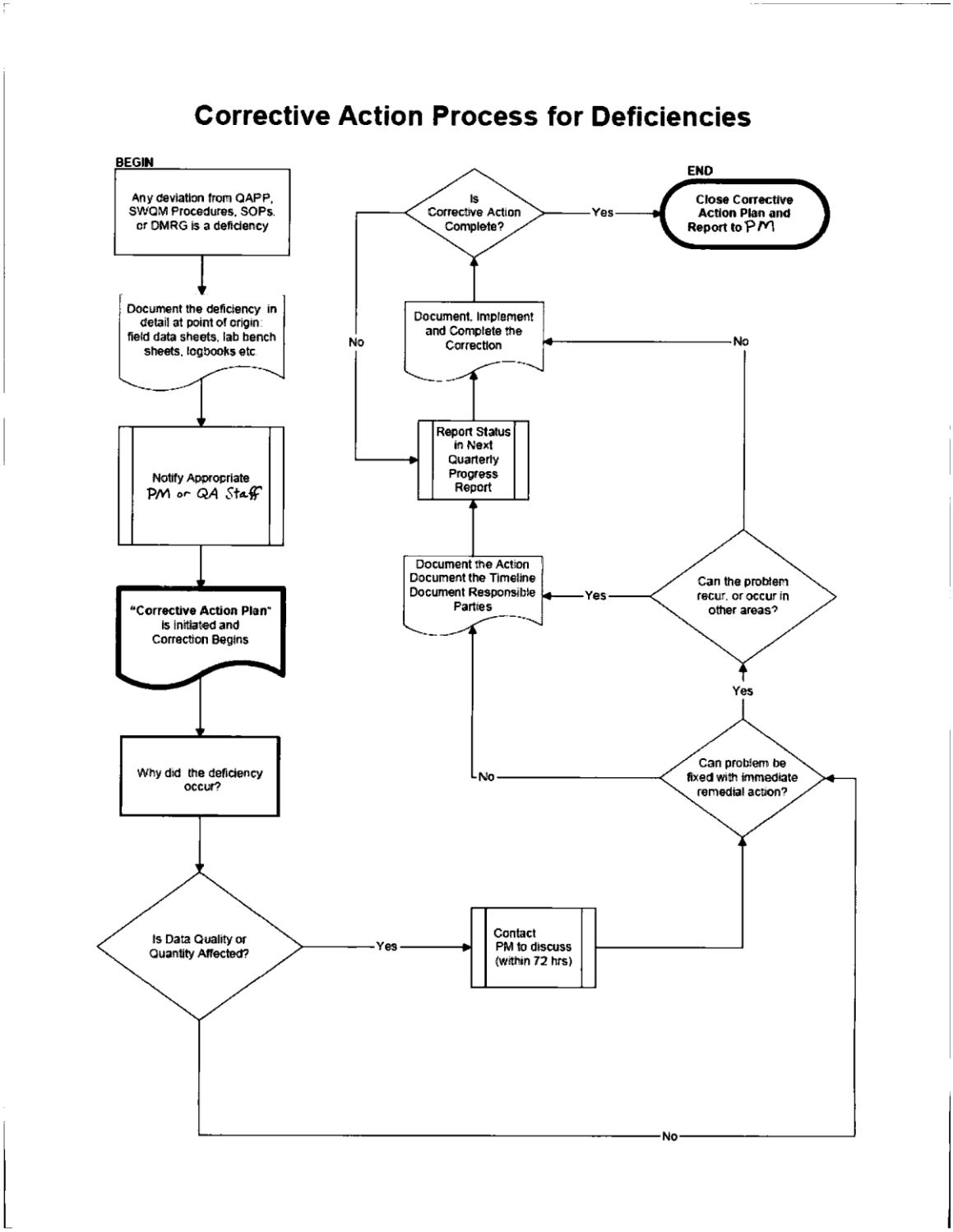
To facilitate the process a flow chart has been developed (see figure C1.1: Corrective Action Process for Deficiencies on the next page).

Status of CAPs will be included with progress reports. In addition, significant conditions which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data will be reported to the AgriLife and TSSWCB immediately.

The H-GAC Project Manager or their designee is responsible for implementing and tracking deficiencies and corrective actions in a pre-CAP log. Records of audit findings and corrective actions are maintained by the H-GAC Project Manager. Audit reports and corrective action documentation will be submitted to the AgriLife and TSSWCB with the Progress Report.

If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work are specified in agreements in contracts between participating organizations.

Figure C1.1 Corrective Action Process for Deficiencies



C2 REPORTS TO MANAGEMENT

Reports to AgriLife Project Management

As part of H-GAC's overall data review procedure, the Eastex Laboratory Manager reviews all laboratory QC data results prior to reporting to H-GAC. Any QC deficiencies are documented by a corrective action report (CAR), which are kept by the Eastex QAO. The H-GAC Project QAO or DM reviews the data results and generates a CAR for any that do not pass project criteria. Any problems associated with sample collection, handling, log-in, or other situations are also documented with CARs. Pertinent supervisors, QAOs, and the TSSWCB Project Manager all review the CARs and provide input and evaluation as necessary prior to data being approved for use or submission to SWQMIS. Project status, assessments and significant QA issues will be dealt with by the H-GAC Project Manager who will determine whether it will be included in reports to AgriLife and TSSWCB Project Management.

Reports to TSSWCB Project Management

All reports detailed in this section are contract deliverables and are transferred to the TSSWCB in accordance with contract requirements.

Quarterly Report - Summarizes AgriLife and H-GAC activities for each task; reports monitoring status, problems, delays, and corrective actions; and outlines the status of each task's deliverables.

Monitoring Systems Audit Report and Response - Following any audit performed by the TSSWCB, a report of findings, recommendations and response is included in the quarterly progress report sent to TSSWCB via AgriLife.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

For the purposes of this document, the term verification refers to the data review processes used to determine data completeness, correctness, and compliance with technical specifications contained in applicable documents (i.e., QAPPs, SOPs, analytical methods). Validation refers to a specific review process that extends the evaluation of a data set beyond method and procedural compliance (i.e., data verification) to determine the quality of a data set specific to its intended use.

All field and laboratory will be reviewed and verified for integrity, completeness, reasonableness, and conformance to project requirements, and then validated against the project objectives and measurement performance specifications listed in Tables A7.1a-d. Only those data supported by appropriate quality control data and meet the measurement performance specifications defined for this project will be considered acceptable, and will be reported to TCEQ Data Management and Analysis Team for submittal to SWQMIS.

D2 VERIFICATION AND VALIDATION METHODS

All field and laboratory data will be reviewed, verified and validated to ensure they conform to project specifications and meet the conditions of end use as described in Section A7 of this document.

Data review, verification, and validation will be performed using self-assessments and peer and management review as appropriate to the project task. The data review tasks to be performed by field and laboratory staff are listed in the first two sections of Table D.2.1, respectively. Potential errors are identified by examination of documentation and by manual examination of corollary or unreasonable data. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues that can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with higher level project management to establish the appropriate course of action or the data associated with the issue are rejected. Field and laboratory reviews, verifications, and validations are documented.

After the field and laboratory data are reviewed, another level of review is performed once the data are combined into a data set. This review step as specified in Table D2.1 is performed by the H-GAC Data Manager and QAO. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of laboratory and field data review, evaluation of field QC results, additional evaluation of anomalies and outliers, analysis of sampling and analytical gaps, and confirmation that all parameters and sampling sites are included in the QAPP.

Another element of the data validation process is consideration of any findings identified during the monitoring systems audit conducted by the TSSWCB QAO. Any issues requiring corrective action must be addressed and the potential impact of these issues on previously collected data will be assessed.

After the data are reviewed and documented, the H-GAC Project QAO validates that the data meet the data quality objectives of the project and are suitable for reporting to TCEQ Data Management and Analysis Team for submittal to SWQMIS. Data Management and Analysis Team prepares the test upload to the production environment of SWQMIS but waits for TSSWCB Project Manager approval of the dataset before completing the upload.

If any requirements or specifications of the TSSWCB project #16-11 are not met, based on any part of the data review, the responsible party shall document the nonconforming activities with a CAR, which will be reviewed and included by the H-GAC Data Manager with the data in the Data Summary. This information is communicated to the TSSWCB and AgriLife by the H-GAC Project Manager, QAO, or Data Manager. Depending on the nonconformance, affected data will be flagged or not transmitted to TCEQ Data Management and Analysis Team for submittal to SWQMIS.

Table D2.1: Data Review Tasks for H-GAC

H-GAC Data to be Verified	Field Task	Laboratory Task (Eastex Lab)	Lead Organization Data Manager Task
Sample documentation complete; samples labeled, sites identified	H-GAC field personnel &/or QAO	Sample Custodian.	
Field instrument pre- and post-calibration results within limits	H-GAC QAO		
Field QC samples collected for all analytes as prescribed in the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring*	H-GAC QAO		H-GAC Data Mgr
Standards and reagents traceable	H-GAC QAO	Lab QAO	
Chain of custody complete/acceptable	H-GAC QAO	Sample Cust.	H-GAC Data Mgr
NELAP Accreditation is current		Lab QAO	
Sample preservation and handling acceptable	H-GAC QAO	Sample Custodian.	
Holding times not exceeded		Lab QAO	H-GAC Data Mgr
Collection, preparation, and analysis consistent with SOPs and QAPP	H-GAC QAO	Lab QAO	
Field documentation (e.g., biological, stream habitat) complete	H-GAC QAO		
Instrument calibration data complete	H-GAC QAO	Lab QAO	
Bacteriological records complete		Lab QAO	
QC samples analyzed at required frequency	H-GAC QAO	Lab QAO	H-GAC Data Mgr
QC results meet performance and program specifications		Lab QAO	
Analytical sensitivity (Minimum Analytical Levels/Ambient Water Reporting Limits) consistent with QAPP		Lab QAO	
Results, calculations, transcriptions checked	H-GAC QAO	Technical Director	
Laboratory bench-level review performed		Head Technician	
All laboratory samples analyzed for all parameters		Lab QAO	
Corollary data agree		Lab QAO	H-GAC Data Mgr
Nonconforming activities documented	H-GAC QAO	Lab QAO	H-GAC QAO
Outliers confirmed and documented; reasonableness check performed	H-GAC QAO	Lab QAO	H-GAC Data Mgr & H-GAC QAO
Dates formatted correctly	H-GAC Data Mgr		H-GAC Data Mgr
Depth reported correctly	H-GAC Data Mgr		H-GAC Data Mgr
TAG IDs correct	H-GAC Data Mgr		H-GAC Data Mgr
TCEQ Station ID number assigned	H-GAC Data Mgr		H-GAC Data Mgr
Valid parameter codes	H-GAC Data Mgr		H-GAC Data Mgr &

H-GAC Data to be Verified	Field Task	Laboratory Task (Eastex Lab)	Lead Organization Data Manager Task
			H-GAC QAO
Codes for submitting entity(ies), collecting entity(ies), and monitoring type(s) used correctly	H-GAC Data Mgr		H-GAC Data Mgr
Time based on 24-hour clock	H-GAC Data Mgr		H-GAC Data Mgr
Absence of transcription error confirmed	H-GAC Data Mgr & H-GAC QAO	Technical Director	H-GAC Data Mgr
Absence of electronic errors confirmed	H-GAC Data Mgr & H-GAC QAO	Technical Director	H-GAC Data Mgr
Sampling and analytical data gaps checked (e.g., all sites for which data are reported are on the coordinated monitoring schedule)	H-GAC Data Mgr & H-GAC QAO		H-GAC Data Mgr & H-GAC QAO
Field QC results attached to data review checklist	H-GAC Data Mgr & H-GAC QAO		H-GAC Data Mgr
Verified data log submitted	H-GAC Data Mgr		H-GAC Data Mgr
10% of data manually reviewed	H-GAC Data Mgr & H-GAC QAO	Technical Director	H-GAC Data Mgr & H-GAC QAO

D3 RECONCILIATION WITH USER REQUIREMENTS

Data produced in this project, and data collected by other organizations (i.e., TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be used in the implementation of the Mill Creek WPP and will be submitted to TCEQ SWQMIS for use as appropriate in the development of the biennial Texas Integrated Report for Clean Water Act Sections 305(b) and for WPP development, water quality standards development, and permit decisions. Data which do not meet requirements will not be submitted to SWQMIS nor will be considered appropriate for any of the uses noted above.

Appendix A. Field Data Sheet

H-GAC – Ambient Monitoring Data Sheet

Date: _____/_____/_____ Station: MC-2 Mill Creek at FM 331, southeast of Bellville

Time (military):_____ Samples Collected by:_____

Total Water Depth at sampling location	meters		# of Days Since Last Significant Rainfall	
Sampling Depth	meters			
Water Temperature	°C			
Specific Conductance	µS/cm			
Salinity	‰	N/A		
pH	standard units			
Dissolved Oxygen	mg/L			

Secchi disk or tube	Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity	Tide Stage
									N/A
meters	1 – low 2 – medium 3 – high	1 – excellent 2 – good 3 – fair 4 – poor	1 – brownish 2 – reddish 3 – greenish 4 – blackish 5 – clear 6 – other	1 – sewage 2 – oily/chemical 3 – rotten egg 4 – musty 5 – fishy 6 – none 7 – other	1 – clear 2 – partly cloudy 3 – cloudy 4 – raining 5 – other	1 – calm 2 – slight 3 –moderate 4 – strong	1 – calm 2 – ripples 3 – waves	1 – no flow 2 – low 3 – normal 4 – flood 5 – high 6 – dry	1 – low 2 – falling 3 – slack 4 – rising 5 – high

Flow	cfs	
Flow Method	1 – gage 2 – electric 3 – mechanical 4 – weir/flume 5 – Doppler	
Estimated Flow	cfs	
Primary Contact, # of People Observed (1-10, >10)		
Evidence of Primary Contact, (1- Observed, 0 - Not Observed)		

Maximum Pool Width	meters	
Maximum Pool Depth	meters	
Pool Length	meters	
Percent Pool Coverage in 500 meter Reach	%	
Comments or Observation		

Fresh (non-tidal) ✓

Marine (tidal) _____

Containers	Preservatives	Analyses	Requested
1 x 500 mL Plastic	Iced	TSS, Turbidity	
1 x 1 L Plastic	Iced, H_2SO_4	TKN, NH3, NO2+NO3, TPO4 Orthophos	
1 x 500 mL Plastic	Iced	CL, SO4	
1 x 100 mL Sterile Plastic	Iced	Bacteria: *E. coli*	
1 x 1000 mL Brown Plastic	Iced	Chlorophyll a and Pheophytin	

Field Split? Yes____ No____

If no,
Date of last split:_____ Surveyor SN:_____ Sonde SN:_____

Updated: July 22, 2014

Appendix B. Chain of Custody Form

EASTEX ENVIRONMENTAL LABORATORY, INC.

P. O. Box 859
Coldspring, Texas 77331
(409) 653-3249 * (281) 350-4080

P. O. Box 631375
Nacogdoches, Texas 75963-1375
(409) 569-8879 * Fax (409) 569-8951

REPORT TO:

(1) Company
Address
Attn.
Phone #
Fax #

INVOICE TO:

(2) Company
Address
Attn.
Phone #
Fax #
P.O. #

(8) ANALYSIS REQUESTED

Sampler's Name (please print)

Sampler's Signature

Project Number

(3) Project Name

(7) Containers

(4) Sample ID	Date	Time	(5) C/G	DO	PH	Cl2	Flow	Temp	(6) Matrix	# Con	Size	Type	Pres

Relinquished By: (Signature) Received By: (Signature) Date Time

Relinquished By: (Signature) Received By: (Signature) Date Time

Remarks:

Received Iced: Yes / No

LAB USE ONLY

Checked In By: (Signature) Date Time

Logged In By: Date Time

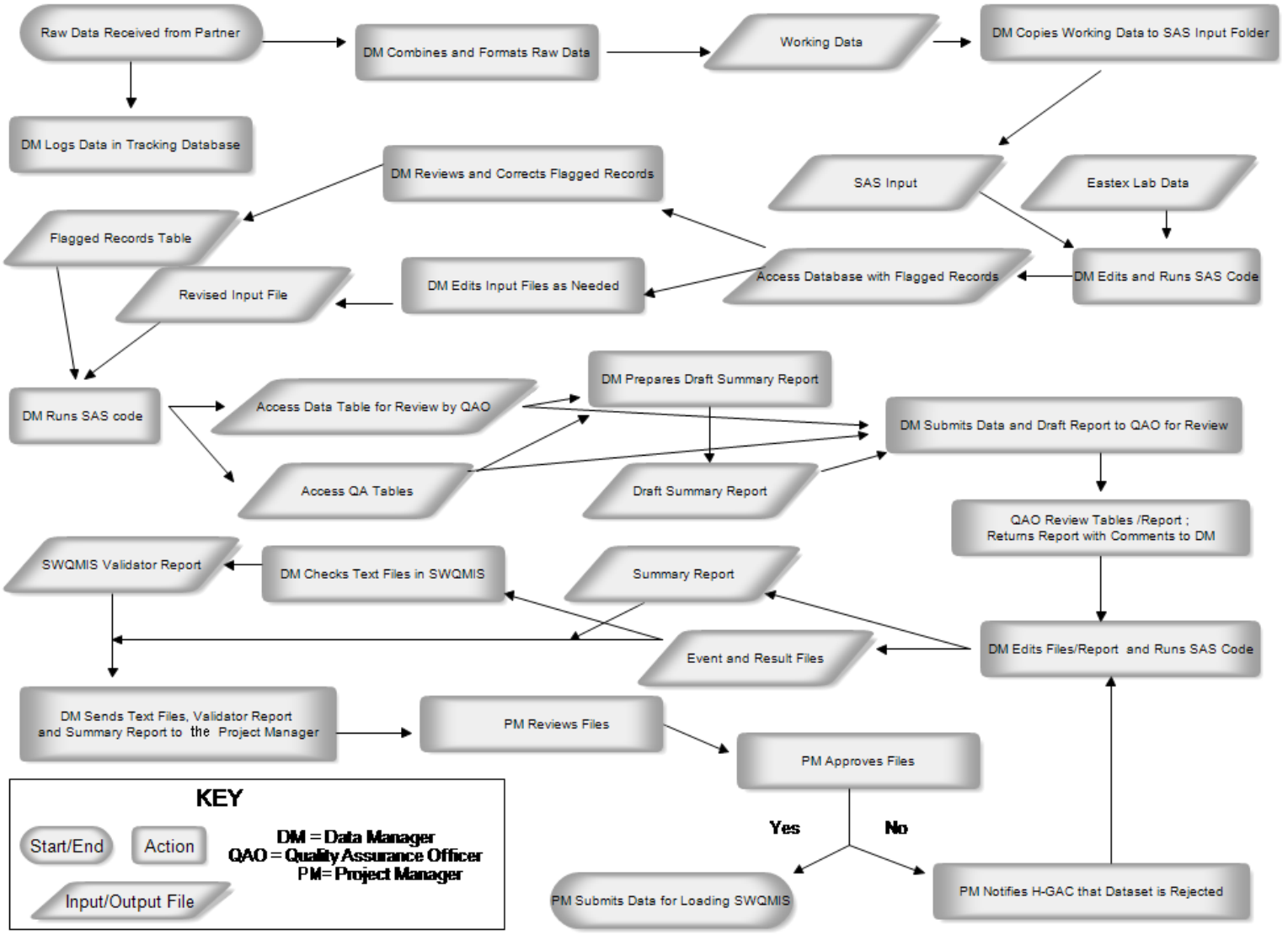
White Copy-Follows Samples
Yellow Copy-Laboratory
Pink Copy-Client Copy

SEE BACK FOR INSTRUCTIONS

Appendix C

Data Management Flow Chart

Data Management Flow Chart



Appendix D Data Summary Report

Data Information

Data Source: _____

Date Submitted: _____

Tag_id Range: _____

Date Range: _____

Comments

Please explain in the space below any data discrepancies including:

- **Inconsistencies with AWRL specifications;**
- **Failures in sampling methods and/or laboratory procedures that resulted in data that could not be reported to the TSSWCB or TCEQ; and**
- **Other discrepancies.**

-

-

-

-

-

-

-

H-GAC Data Manager: _____

Date: _____

H-GAC QAO: _____

Date: _____

Houston-Galveston Area Council
Clean Rivers Program
Data Summary

Data Information

Data Source:	**HG (source 1) HG (source 2)**
Date Submitted:	**March 5, 2015**
Tag ID Range:	**I050455 - I050508**
Date Range:	**7/12/14 – 12/17/14**

Comments

1. This report addresses ambient and 24-hour dissolved oxygen monitoring data, all of which is attached to this email.

2. Summary statistics for 24-hour DO monitoring events are calculated from raw data downloaded from the datasonde, and are assumed to be correct if the datasonde has passed post-calibration and the data series shows the sonde was always in the water. Outliers flagged by the SWQMIS validation algorithm are reviewed and accepted by H-GAC.

3. Total Kjeldahl nitrogen (TKN) is analyzed at all stations. There are 30 results in this dataset.

4. The CRP QAPP specifies a limit of quantitation of 1 MPN/100 mL for *E. coli* (31699), achievable when 100 mL of sample is analyzed. In some cases a smaller aliquot must be analyzed in order to obtain results below the maximum quantitation limit of the method (2400 MPN/100 mL). Historical information is used by the laboratory to determine if analysis of less than 100 mL is warranted. All results that suggest an aliquot of less than 100 mL was analyzed were confirmed by H-GAC in consultation with the laboratory. Eastex Laboratory does not analyze 100 mL aliquots; the effective LOQ is 10 MPN/100 mL.

5. Dissolved solids may interfere with quantitation of enterococci (31701) using the IDEXX Enterolert® method. A 1:10 dilution of saline (tidal) samples is analyzed to overcome matrix interference. Accordingly, the quantitation limit

for estuarine (brackish) waters is 10 MPN/100mL. All results associated with a higher quantitation limit were confirmed by H-GAC through consultation with the laboratory.

6. Water color (89969) or odor (89971) are only reported as "Other" ("6" and "7" respectively) if H-GAC has confirmed that a description is included in the "Comments" field.

7. Samples from all stations were analyzed for enterococci. There are 30 enterococci results and 24 *E. coli* results in this dataset.

8. Chloride (00940) and sulfate (00945) are typically analyzed and reported for nontidal sites only. There are 24 results for each parameter in this dataset.

9. Salinity (00480) is reported for tidal sites only. There are fourteen (14) results in this dataset.

10. Flow severity (01351) is reported for nontidal sites only. Twenty-four (24) results are included in this dataset.

    a. Flow severity could not be assessed at station 12135 on 9/30/14. The stream was overgrown with vegetation and water could not be seen.

11. There are twenty-eight (28) flow (00061) results in the dataset. Flow is not measured at tidal sites.

    a. Flow was not measured at station 20462 because the stream was difficult to access, and was sampled from a bridge

    b. Flow was not measured at station 20723 because the banks were slick and unstable; samples were collected from a bridge.

12. Twenty-four hour dissolved oxygen data for three events in July and August were omitted from the previous submission of 24-hour dissolved oxygen data, and are included in this dataset:

    a. Station 11123, 7/12/14 (flow data submitted in December 2014)
    b. Station 16611, 8/31/14 (flow data included in this dataset)
    c. Station 18818, 8/31/14 (flow data included in this dataset)

13. Instantaneous flow (00061) data for two 24-hour dissolved oxygen events (stations 16611, 18818, 5/22/14) is included in this dataset. It was omitted from the previous submission of 24-hour dissolved oxygen data.

14. No data are reported for a 24-hour dissolved oxygen monitoring event at station 11117 in October. This is a tidal site, with a cyclically varying depth. The datasonde was suspended too high in the guard column to remain submerged for an entire 24-hour period. Of the fifteen-minute measurements, the depth was "negative" (in the air) for 235. The datasonde was at a depth greater than 0.1 meters at only ten points.

15. The datasonde did not pass dissolved oxygen post-calibration on 11/19/14. Dissolved oxygen (00300) data are not reported for five events.

16. Stations 17937 and 20721 could not be sampled on 10/22/14 and 10/1/14 respectively due to bridge construction activity.

17. Peach Creek (20722) was dry on 10/1/14. The applicable qualitative parameters are reported in this dataset.

18. Stations 20721 and 17397 could not be sampled due to construction activities.

19. The following outliers were verified by H-GAC and/or Eastex Laboratory staff:

    a. TKN (00625) : One result

Houston-Galveston Area Council
CRP Data Manager Bill Hoffman Date 3/5/15

Houston-Galveston Area Council
CRP Quality Assurance Officer Jean Wright Date 3/5/15

Appendix E Corrective Action Report

Corrective Action Plan		
Report No.:	**Issued By:**	**Date Issued:**
Monitoring Entity Involved:		**Date Closed:**
Description of deficiency:		
Root Cause of deficiency:		
Programmatic Impact of deficiency:		
Does the seriousness of the deficiency require immediate reporting to the TCEQ? If so, when was it?		
Corrective Action to address the deficiency and prevent its recurrence:		
Proposed Completion Date for Each Action:		
Individual(s) Responsible for Each Action:		
Method of Verification:		

Appendix F Data Management Process

H-GAC's Surface Water Quality Data Management Process

1. When the data manager receives field and laboratory data from individual local partners, all electronic files are saved in the partner's 'Raw Data' folder. The data may be in the form of Excel spreadsheets, Access tables, scanned field data collection forms, or files downloaded directly from field instrumentation. If data summary checklists have been submitted as electronic files, they are also stored in this folder. Hard copies of data, data summary checklists, calibration records, or other physical data are filed for subsequent data entry by H-GAC staff and for reference during the data review and validation process. In addition, receipt of the data is documented in the "CRP Data Tracking" database, currently found at G:\CE\Databases\Clean_Rivers_Program\CRP Data Management \CRP Data Tracking.accdb.

   No modifications or corrections are made to files in the raw data folders.

2. Raw data files are then copied to the partner's "Working Data" folder. All modifications to the data prior to SAS processing are performed on the files in the "Working Data" folder. Compilation of the submitted data, where necessary, is performed by the H-GAC data manager. This typically involves combining and re-formatting spreadsheets or database tables, as well as other data management tasks. Field/variable names are changed to standardized formats, parameter names in the raw data files are replaced by TCEQ parameter codes, and data types are changed as required. (specific information is found below). Most of these tasks are performed after the data has been imported into the SAS environment for processing. In rare cases (e.g. to correct a data entry error or add data that was not entered prior to submission) H-GAC staff may enter data manually into the working file or add SAS code to make the change. Because the measurement performance specifications found in the A7.1 table may vary from one QAPP to another, the working data file does not include data collected under two different QAPPs. The file may, however, contain information from more than one month within the fiscal year covered by an individual QAPP.

3. Field and laboratory data for specific sample sites (monitoring stations) are combined during SAS processing.

4. During SAS processing, all fields (columns) in the compiled dataset are renamed and reformatted to comply with SWQM data management guidelines. Consult the most recent version of the "Data Management Reference Guide for Surface Water Quality Monitoring "for further information.

   a. The fields containing sample site, sample date, sample time, and sample depth are renamed STATION_ID, ENDDATE, ENDTIME, and ENDDEPTH respectively.

   b. The parameter names used by the partner are replaced by the TCEQ parameter code, preceded by an "S" to ensure that the data is read by SAS procedures as text

data.

c. Example: The field or column for dissolved oxygen is renamed “S00300”.

5. The units of measurement as reported by the partner may not comply with SWQM guidelines. In most cases the SAS code will make the conversion to the correct units. If it is discovered that the code for conversion has not been written or is incorrect, or if the partner does not report the results consistently, manual conversion of the units may be necessary. In many cases, the SAS code will flag any records reported in the wrong units for other reasons (below or above screening values, for example), and the correction can be made using SAS.

6. If the SAS code does not include an algorithm for reformatting dates and times, the data manager ensures that these data are formatted as mm/dd/yyyy and hh:mm respectively prior to import.

7. Any parameters that are not included in the A7.1 table for the partner should be removed from the dataset. In most cases, the SAS code specifies the parameters (storet codes) that are to be included in the output text files. It may be necessary to modify the SAS code if unwanted parameters appear in the final dataset.

   Note: While references appear in this document to modification of the SAS code, these are for expository purposes only. The code should only be modified by a person who is very familiar with SAS programming in general, and the CRP processing code in particular.

8. When a database table(s) or Excel spreadsheets containing all field and laboratory data have been compiled and reformatted (if needed) as described above, they are saved to the SAS input folder within the “SAS Data Processing” folder (currently at Q:\CE\Clean Rivers\DATA\SAS_Data_Processing) as an Access database or an Excel file. The input file should be renamed to include a code identifying the partner and the date range of the data.

9. As part of SAS processing, tables containing laboratory –specific quantitation limits, TCEQ minimum and maximum screening values, and site name / monitoring station ID correspondences are imported for comparison to the partner data. At the beginning of the period under which a specific QAPP is applicable, the data manager ensures that the tables containing this information correspond (where applicable) to the A7.1 tables. The data manager updates these tables at other times as needed.

10. The data manager modifies the SAS program used for the partner’s most recent dataset for processing of the current data as follows.

    a. The most recent SAS program for the partner is saved with a name identifying the partner and date range of the data.

b. All references to input and output files within the program are replaced with a name identifying the partner and date range of the data, and the program is saved

c. The program is executed through the step where "Flagged_Records_1" is created.

11. The SAS program creates a new Access database in the "Access" folder within the "SAS Data Processing" folder. The database should have the same name as the input file.

    a. The database contains at least two tables: The "Input_Data_Matrix" that contains all data in the input file, and the "Flagged_Records_1" table.

12. The data manager updates the "CRP Data Tracking" database to include the date of initial SAS processing.

13. The "Flagged_Records_1" table identifies questionable data that must be investigated by the data manager. The table is generated from comparisons against screening levels to identify outliers, quantitation limit tables to identify improperly reported data, and a variety of other comparisons. The program includes algorithms to identify the following:

    a. Reported values beyond TCEQ screening limits (outliers)
    b. Values reported as negative numbers
    c. Illegal values (e.g.,, results for qualitative parameters that are not in the range of allowed values)
    d. Reported orthophosphate that exceeds the reported total phosphate
    e. Nitrate+nitrite concentration is less than nitrite concentration
    f. Inconsistent observed turbidity and water clarity results
    g. Inconsistent water surface and wind intensity results
    h. Other algorithms are added to the QA protocol as needed.

14. The data manager is responsible for reviewing each flagged record against available raw data, data submittal checklists from the partner agency, instrument calibration records, and so forth, and where necessary obtaining additional information from the partner agency in order to determine the appropriate action to be taken. The flagged records table contains a variety of fields for documenting the disposition of the problem. In summary, a flagged record is accepted (on the basis of verification by the data manager), replaced with a corrected value, or deleted. A code is entered into the "Action" column, the "Verification Method" code is entered, and the initials of the responsible party are entered in the "Verified By" column.

    a. "Verification Method" codes currently in use are DR (document review) and PJ (professional judgment).

15. At present, there is a subset of data quality problems that cannot be identified or corrected using the flagged records table. It may be necessary to make changes to the input file to correct some errors and inconsistencies identified during subsequent review by the data manager or quality assurance officer.

16. All written communications with the staff of partner agencies that are made during the data verification process are printed and retained with the final data package that is retained by H-GAC. Records of telephone conversations are also retained.

17. Before changes are made to each data set, the data manager creates a "Data Summary Report/Sheet" for that specific data set. The data summary report is created from the most recent data summary report for that partner agency, and saved with the name of the current data set. All changes to the data and/or action taken on the data set are documented in this report. In addition, summary narratives discussing missing data, outliers that were verified and accepted, explanations of variations in reporting the data, failure to meet A7.1 LOQs, and so forth are also included. Pertinent information from the data submittal checklist submitted by the partner agency is also included in the final report. This report is submitted to TCEQ with each data set.

18. The data submittal checklist submitted by the partner agency is reviewed for the following, at minimum:

    a. If the quality control information included in the report indicates that data has been reported that did not meet the measurement performance specifications of the A7.1 tables, it will be removed from the dataset. The removal will be noted on the "Data Summary Report/Sheet."

    b. If the quality control information included in the report indicates that data has been reported that did not meet method-specific quality control criteria, the impact on data usability will be evaluated. Data may be removed from the dataset if legal defensibility is questionable. The removal will be noted on the "Data Summary Report/Sheet."

    c. The post-calibration error limits in the partner agency's data submittal checklist shall be checked against requirements, as well as raw calibration records if available.

    d. Reports of missing data, and the reasons that the data is missing (QC failure, spilled sample, could not sample site, etc.)

19. The SAS program is re-run following action on all flagged records. The flagged records table is read back into the process, and a variety of new tables and files are created. The most important of these are the "Draft_Data_Matrix" and the pipe-delimited text files that are submitted directly to TCEQ.

a. The portion of the SAS code that assigns TAG ID numbers is edited prior to generating the second group of tables and files.

20. The data manager queries a subset of data from the "Draft_Data_Matrix" table and reviews it against hard-copy raw data to check for random transcription errors. A sufficient number of records are selected so that when added to the flagged records previously evaluated, at least ten percent of submitted data has been verified against raw data. The query results are printed and retained with the data package as a record of data review.

21. The data manager creates and views a totals query of the "Draft_Data_Matrix" table to identify missing records that have not been addressed in the data summary report.

22. The data manager completes the draft data summary report, and updates the "CRP Data Tracking" database with the date the draft was completed.

23. The summary report is submitted to the quality assurance officer (QAO). The "Draft_Data_Matrix" and draft summary are reviewed by the QAO , who identifies all values that, in the QAO's judgment, are unreasonable, are unverified outliers, or are otherwise questionable. Written comments and concerns are returned to the data manager for further investigation and correction of the dataset (where warranted). Newly identified discrepancies are investigated, and documented on the data summary report.

24. The data manager reviews the written comments, takes the appropriate action, and documents any additional actions on the data summary report. In most cases, the SAS program will be run at least one more time, although a new flagged records table is not routinely created. In the event there has been extensive modification of the input dataset, a new flagged records table may be created. The written comments from the quality assurance officer, with annotations by the data manager, are retained with the data package as a record of data review and modification (where applicable). The date of data summary report approval is added to the "CRP Data Tracking" database.

25. The text files created by the SAS program and the final data summary report are then submitted to TCEQ by the data manager. The data is first submitted to the SWQMIS (database) validation algorithm to obtain a validation report; the files are then emailed to the CRP Project Manager at TCEQ.

    a. The data manager copies the event and result files to the desktop.
    b. Each file is edited to remove the header line (field names).
    c. The data manager logs into the SWQMIS system, and submits the files and data summary report as described in the most current version of the *SWQM Data Management Reference Guide* (https://www.tceq.texas.gov/waterquality/data-management/dmrg_index.html , retrieved 8/15/2017).
    d. If the system identifies validation errors, upload is canceled and the validation errors are investigated and corrected. In some cases this may involve editing the

text files only. If this option is selected, document changes to text files appropriately. It may be most convenient to document minor changes to the text files in the "Comments" section of the appropriate record in the "CRP Data Tracking" database.

e. When no validation errors are found, the upload is completed, and a validator report is created and saved report (with a unique file name) as an html file.
f. The data manager reviews the validator report to identify remaining discrepancies between the dataset, data summary report, and A7.1 table requirements that may have been missed. The appropriate actions, to include resubmission of the data to obtain a revised validator report, are performed.
g. The text files, data summary report, and validator report are e-mailed to the CRP Project Manager.
h. The validator report is saved in the "Data Review and Submission Docs" folder at Q:\CE\Clean Rivers\DATA\Data\Data Review and Submission Docs."

26. The data manager updates the "CRP Data Tracking" database to include the date the files were sent to TCEQ, and add hyperlinks to the data summary and validator reports.

27. If the CRP Project Manager identifies further problems with the dataset, the appropriate action is taken and revised datasets or data correction requests (where appropriate) are submitted. Written communications with the CRP project manager are printed and retained on file with the data package to serve as a record of validation and modification of the dataset.

28. When the dataset is accepted by TCEQ and loaded into SWQMIS, the data manager updates the "CRP Data Tracking" database to include the acceptance date.

29. All data management activities are documented in an Access database ("CRP Data Tracking") maintained by the Data Manager. The database contains details of receipt, processing, submission, and acceptance by TCEQ, and includes hyperlinks to raw and final datasets, data summary reports, and data validation reports.